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REMOTE MEDICAL DIAGNOSIS SYSTEM (RMDS) DESIGN REVIEW MEETING MI--ETC(U)

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## REMOTE MEDICAL DIAGNOSIS SYSTEM (RMDS) DESIGN REVIEW MEETING MINUTES 27-28 AUGUST 1980

WT Rasmussen  
I Stevens

August 1981

Prepared for  
Bureau of Medicine and Surgery

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SL GUILLE, CAPT, USN

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Technical Director

ADMINISTRATIVE INFORMATION

This technical document is one in a series on the Remote Medical Diagnosis System (RMDS), NOSC project CM38, sponsored by the Naval Medical Research and Development Command. This document contains the minutes of a design review meeting for the RMDS held 27-28 August, 1980, at the Bureau of Medicine and Surgery (Department of the Navy), Washington, DC. Also included in the appendices of this document are additional data obtained in meetings subsequent to the design review meeting. This document was prepared by the NOSC Bioengineering Branch (Code 5123), and was sent to all meeting participants for review and changes prior to final publication.

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## SECTION 1

### INTRODUCTION

#### PURPOSE

This document contains the minutes of a design review meeting for the Remote Medical Diagnosis System (RMDS) held 27-28 August, 1980 at the Bureau of Medicine and Surgery (Department of the Navy), Washington, DC. These minutes reflect the discussions held and information exchanged at this review meeting. They paraphrase various discussions, and are not intended as complete verbatim minutes. This document also contains background and reference material on the RMDS project.

#### DESIGN REVIEW MEETING SCOPE

The Remote Medical Diagnosis System program is about to enter the procurement cycle for Engineering Development Models (EDMs). Before the complete system design and technical specifications are finalized, and during the entire procurement cycle, several Naval activities must be consulted for program and technical review and to obtain their operational inputs.

A system design review meeting for the RMDS was held, with all concerned Naval activities (see Section 4) invited, on 27 and 28 August, 1980. This meeting was held before finalizing the system technical requirements for the Request for Proposals (RFP) for the EDMs. Participants were briefed by NOSC and BUMED on RMDS requirements and the proposed maintenance philosophy. Shipboard installation and interface requirements, and communication security and encryption requirements, were discussed to resolve policy issues.

#### RMDS PROGRAM BACKGROUND

The mission of the Remote Medical Diagnosis System is to improve medical diagnosis at remote sites. This is accomplished by transmitting medical data and diagnostic information between remote ship or shore sites and full-capability medical centers. The RMDS will enable the medical personnel at a remote site to contact a physician at a diagnostic center (ashore or shipboard) and transmit a visual or auditory presentation of the medical data needed for diagnosis, such as patient history, laboratory tests, ECG tracings, X-ray images, images of a patient injury, heart-lung sounds, and verbal descriptions. By return link, the physician will be able to send diagnosis and treatment information. The communication requirements for this are satisfied by any two-way, voice-grade, narrowband communication channel such as telephone line, hf or uhf radio, or satellite links.

The system consists of the RMDS terminals, existing voice-grade communication links to interconnect the terminals, and user personnel. All the hardware unique to the system is contained in the terminals, including a TV camera, TV monitor, electronic stethoscope, ECG monitor, and audio handsets; and the electronics package, consisting of signal modulator, demodulator, and modems.



Shipboard feasibility tests of an early RMDS prototype were completed during FY 75-76. This testing showed that the concept was feasible and that equipment could be developed to meet the requirements using available technology. Advanced Development Models (ADMs) were specified, and procured in September 1977.

The USS ENTERPRISE (CVN-65) was designated as the test ship for the at-sea tests to determine operational suitability of the RMDS ADMs. The at-sea tests were performed in February and March 1978. One of the terminals was installed in the sickbay area on board the USS ENTERPRISE. The second terminal was located at the Naval Ocean Systems Center (NOSC), San Diego, California. Laboratory tests to determine technical performance capabilities, and radiograph resolution tests to determine clinical utility of the ADM units, were performed between April 1978 and June 1979. The technical requirement issues for the RMDS were resolved as a result of these tests. From this background of experience and test data, draft system specifications were prepared for this design review meeting.

#### DESIGN REVIEW MEETING AGENDA

Wednesday, 27 August 1980

1300-1310	Greetings & Introduction CAPT D.B. Lestage, MC, USN BUMED - 03C
1310-1315	Introduction of Project Management Personnel CAPT B.R. Blais, MC, USN BUMED - 3C3
1315-1330	Opening Remarks RADM C.H. Lowery, MC, USN BUMED - 03
1330-1400	RMDS Project Overview Dr. J. Silva NOSC
1400-1430	Engineering Development Models Dr. W.T. Rasmussen NOSC
1430-1445	Break
1445-1530	Communications & Security Mr. I. Stevens NOSC

1530-1630

#### User Inputs

- Medical personnel requirements
- Protocol to request system use
- Protocol to request and establish communication link

Thursday, 28 August 1980

0830-0900

#### Funding Responsibilities

- Fleet implementation funding
- Budget planning

0900-1030

#### Communications & Security

- Encryption requirements
- Secure lines to NRMC
- TEMPEST requirements
- Communication network
- Communication budget & plans

1030-1045

#### Break

1045-1115

#### System Specifications

- Militarization/ruggedization requirements
- Quality assurance
- System installation

1115-1145

#### Test and Evaluation Master Plan (TEMP)

1145-1215

#### System Design

- Communication interfaces
- Shipboard space availability

1215-1240

#### Logistics and Support

- Maintenance
- ILSP

1240-1300

#### RMDS Project Visibility

1300

MEETING ADJOURNED

## ITEMS ADDRESSED DURING MEETING

### Specification Review

1. How ruggedized should the EDMs be?
2. Which MIL-E-16400G conformance tests must be performed?
3. Which activity will oversee installation of the EDMs?
4. Are there any potential problems with EDM installation?
5. Are EDM operational characteristics acceptable?
6. Who will be responsible for production models installation?

### Communication Security

1. Should voice and data be encrypted?
2. If voice and data are to be encrypted, where will decryption take place and how are the voice and data to be transferred to a Naval hospital?
3. How will hf, uhf, and satellite frequencies be assigned for RMDS EDM use?
4. If hf and uhf must be encrypted, what interface is required?
5. Can shipboard communication equipment, e.g., ON-143, KG36, VOCODER, and DAMA, be used on a time-shared basis by RMDS? What priority would RMDS have and who sets the priority?
6. Is a separate red phone required for secure voice? Can it be incorporated as part of EDM equipment?
7. What are the system TEMPEST requirements?

### Logistics

1. Who has the financial and equipment maintenance responsibility for EDMs?
2. Who has the financial and equipment maintenance responsibility for production models after ASU has been obtained?

## SECTION 2

### DESIGN REVIEW MEETING MINUTES

These minutes are intended to reflect the discussions held and information disseminated at the design review meeting; they may paraphrase various discussions. As a result of the design review meeting and follow-on meetings, some system design concepts and specifications have been modified; these changes are reflected in the figures in this document.

WEDNESDAY 27 AUGUST 1980; 1300

#### INTRODUCTION

##### CAPT D. Lestage (BUMED):

Offered opening greetings and outlined short background of BUMED's recent involvement with the RMDS project.

A project status review meeting was held with VADM W. Arentzen and some of his staff in September 1979. It was decided at that time that BUMED did want the system, and that BUMED would lend every effort that they could to assist in the implementation of the system. At that time CAPT Lestage was appointed as the program coordinator for the project, and CAPT B. Blais was appointed as the BUMED action officer.

A meeting was held at OPTEVFOR, Norfolk, VA in October 1979, with the BUMED representatives, CAPT R. Ireland (OPNAV-098E), CDR J. Bates (NMRDC), the NOSC representatives, and the OPTEVFOR representatives. The program has been on track and has evolved successfully since that time. It was felt that the time had come for this design review meeting so that future planning could be made.

##### CAPT R. Ireland (OP-098E):

Reported that "Navy Decision Coordinating Paper for Medical/Dental Equipment Development," "Mini" NDCP #M-0933-PN (which includes RMDS) was signed by VADM D.F. Emerson, USN (OP-098) on 25 August 1980 (Appendix C, reference 7).

##### CAPT B. Blais (BUMED); Chairman of the meeting:

Introduction of project management personnel:

Program Sponsor and Coordinator	OP-931F	CAPT D. Lestage, MC, USN
BUMED Project Officer	MED 3C3	CAPT B. Blais, MC, USN

Project Manager	NMRDC-45	CDR J. Bates, MSC, USN
Development Coordinator	OP-098E	CAPT R. Ireland, MC, USN
CHNAVMAT Coordinator	MAT083E12	J. Sivy
Developing Agency Test Director	NOSC	Dr. W. Rasmussen
Operational Test Coordinator	COMOPTEVFOR 64	LCDR J. Baldwin, USN
Operational Test Director	COMOPTEVFOR 643C	RMC D. Decker, USN

Introduction of RADM C. Lowery, MC, USN, BUMED-03.

RADM C. Lowery (BUMED):

Reported that there still seem to be some misgivings as to the establishment of an operational requirement, and some serious doubts by some as to the utility of the Remote Medical Diagnosis System (RMDS). There are two important issues to be stressed:

1. This system will not be installed on any ship before 1986; therefore, we should be looking at what level of medical care we want in 1986 and later, and what possible missions the Navy may be faced with at that time. Some foresight is required now to evaluate what the Navy's medical needs will be, and how we can technically support our medical personnel in the fleet.
2. This program will go nowhere if it does not receive unanimous support from the medical community. Once the decision has been made that there is an operational requirement for the RMDS, the Navy Medical Department must stand behind that decision.

CAPT B. Blais (BUMED):

The concept of RMDS goes back to 1973 when CAPT J. Johnson, MC, USN, was in Bureau of Medicine, Code 5, and saw the problem of the decreasing number of physicians onboard ships. He requested a study at that time to determine the requirements to support our medical personnel in the fleet. The Naval Electronics Laboratory Center (NELC) (now Naval Ocean Systems Center (NOSC)) became involved at that time.

I (CAPT Blais) became involved in this project in Spring 1979 when I was assigned to the Military Sealift Command (MSC). At that time, RADM J. Johnson, USN (who was Commander, Military Sealift Command, and is now VADM Johnson, COMNAVSURFLANT) directed me to implement a program to improve medical care on the MSC ships. Health care on the MSC ships is less adequate than that on the Navy ships, since the general policy is that on 50% of the MSC ships the First Officer (with 16 hours of first aid training and 8 hours of CPR training) is responsible for the total health care of the ship. The other 50% of MSC ships are manned by independent duty corpsmen or MSC

nurses. VADM Johnson was adamant at that time, and is still adamant, that RMDS-type equipment is needed for both the MSC and the Navy ships, not only for communications between ships, but also for communications back to a large hospital for decisions regarding diagnosis, treatment and evacuations of patients.

The Coast Guard has become interested in medical capabilities on maritime ships due to the large number of requests for medical advice. At the present time, the majority of the American flag ships are medically manned by the master or First Officer. They have recommended a new requirement for ships of maritime industry such that all intercontinental ships have the equivalent of an independent duty corpsman. In addition, they are also interested in better communication systems, such as RMDS, to reduce some unnecessary Search and Rescues (SARs). The review of some 1979 Coast Guard data shows there were 433 requests for medical assistance, and 358 medivacs were carried out. Two helicopters and a crew of four were lost during these operations. In reevaluations of these medical cases when they reached a hospital or appropriate medical care, it was determined that 193 of these would not have had to be evacuated if adequate medical care had been available, or if adequate information had been available before the medivac. Although these findings are dealing with maritime ships with less medical care available and an older population, in general, than on our Navy ships, we still need to give our medical personnel the additional support so we can prevent the air evacuations that are not required, as well as the psychological support from appropriate consultation that their diagnosis and treatment are correct.

CAPT J. Johnson (NAB, Little Creek):

In 1973, BUMED enlisted the help of NELC (now NOSC) to look at the requirements of shipboard medical care. Two questions were looked at: (1) what really happens onboard ship (illnesses, injuries, etc.), and (2) overall, are the shipboard medical capabilities sufficient to meet the everyday and emergency needs of the ship. Shipboard medical manning and medical equipment were examined and compared to what was required to handle the daily needs.

The consensus was that these needs were not met, and several aspects developed from this study. One was the initiation of the 44-week training program for independent duty corpsmen, and another was a reformatting and updating of the Authorized Medical Allowance Lists (AMALs).

This particular element of investigation, which began in 1974, was to address a method of communicating ongoing medical consultation between the fleet and the shore to ensure that the requirements of the fleet were met. Rather than just buying "medical equipment" and putting it onboard ships and telling them to use it, we initiated a feasibility study to see if equipment could be obtained or developed which:

1. Would piggy-back on existing communication equipment,
2. Could be made operational without creating any further maintenance requirements on the electronic technicians onboard ship,
3. Could be made to perform,
4. Would be reliable, and
5. Would transfer the information needed to provide improved diagnostic capabilities.

RMDS-type equipment is not only intended to reduce or even aid in medical air evacuations, but, even more important, to help achieve the maximum utilization of personnel while deployed in remote areas.

Through the studies conducted over the following years, it was shown that this equipment is feasible -- technically it can work. The biggest technical problems proved to be in the communication interfaces. A second factor was that this type system may be needed even more today than it was then to aid our medical personnel.

The questions now are: is it worth it to continue on from here?; can we afford it?; does everybody agree that the requirement still remains?

Dr. J. Silva (NOSC):

I want to add in addition to ADM Lowery's remarks that if the medical community is not unified in its support of RMDS it will never be implemented. It should be noted that if we do not convince the fleet that what we put on the ship will in no way compromise the fulfillment of the mission of that vessel, then we have lost the battle.

We at NOSC are technical representatives for the Navy medical community. This system (RMDS) is not our concept, but has grown out of the operational needs and requirements of the fleet, and the technical inputs from Navy medical and communications personnel. Our mission is to provide an engineering arm and bring forth the best technology available for a specific requirement, not to sell a project or system.

#### RMDS PROJECT OVERVIEW

Dr. J. Silva (NOSC):

The following figures refer to the vu-graphs that were shown and discussed.

Figure 1 states the goal of the RMDS project, and figure 2 shows the system objectives. Figure 3 reflects a summary of the past major study areas for the RMDS project: from the initial baseline requirements study in FY 73, to the first shipboard feasibility tests in FY 75-76, the design, procurement and testing of the Advanced Development Models (ADMs) in FY 77-79, the determination of the system technical/operational requirements as a result of the ADM testing, and the completion of system specifications for the Engineering Development Models (EDMs) in FY 80-81.

The feasibility tests of FY 75-76 are illustrated in figure 4. Three ships, the USS JUNEAU (LPD-10), USS FORT FISHER (LSD-40) and USS ALAMO (LSD-33) participated in these tests during operations off Southern California and a deployment to WESTPAC. Voice and video data were transmitted between ships, using hf/uhf radio communications, and to NOSC or the Naval Regional Medical Center (NRMC) San Diego via Naval Communications Stations (NAVCOMMSTAs) at Philippines, Guam and San Diego. The equipment used for these feasibility tests was an off-the-shelf, commercially available, slow-scan video-voice system made by RCA Global Communications. Figure 5 shows this system, as modified for shipboard use, on the USS JUNEAU, and figure 6 shows the equipment at NRMC, San Diego.

# **PROJECT GOAL**

**Effective medical data transfer for  
emergency consultation purposes to  
support shipboard medical personnel.**

- Ship-to-ship**
- Ship-to-shore**

Figure 1. Project goal.



## **SYSTEM OBJECTIVES**

- 1. Transmit and receive voice and data.**
  - Analog and digital voice
  - Digital data
- 2. Utilize Navy narrowband (3 kHz bandwidth) communication channels at data rate of 2400/4800 bits per second.**
  - UHF
  - HF
  - Satellite
  - Telephone
- 3. Exchange medical data:**
  - Patient records
  - Test results
  - Electrocardiograms
  - X-ray images
  - Patient images
  - Heart-lung sounds
  - Verbal information

Figure 2. System objectives.

## **PROJECT SUMMARY**

<b>Milestones</b>	<b>FY</b>
• <b>Baseline Requirements Study</b>	<b>73-74</b>
• <b>Feasibility Study</b>	<b>75-76</b>
• <b>Advanced Development Model (ADM) specification &amp; fabrication</b>	<b>77</b>
• <b>ADM Laboratory &amp; Shipboard Tests</b>	<b>78-79</b>
• <b>System Technical/Operational Requirements</b>	<b>79-80</b>
• <b>Engineering Development Model (EDM) system specifications</b>	<b>80-81</b>

Figure 3. Project summary.

# FEASIBILITY TEST

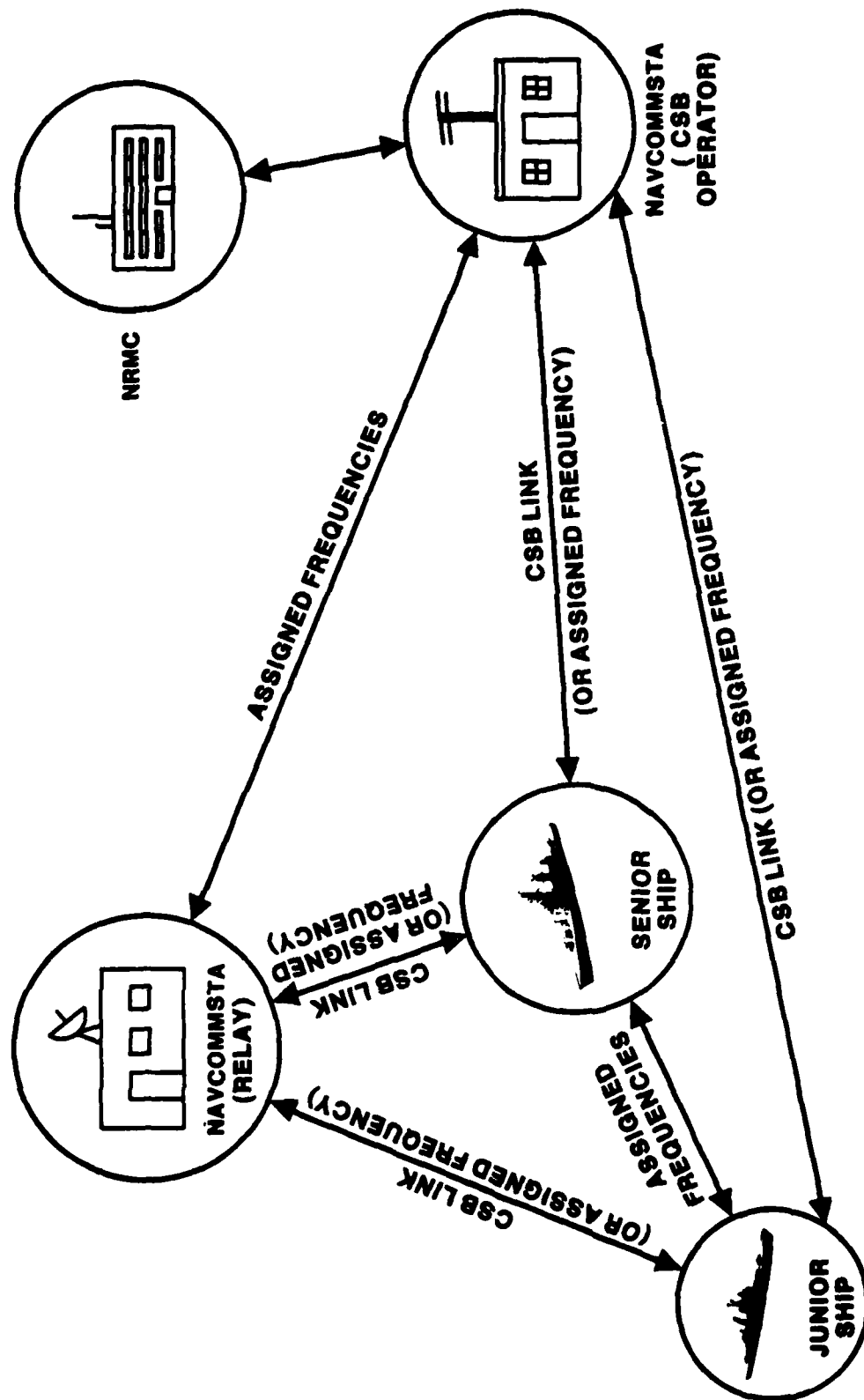


Figure 4. Feasibility test.



Figure 5. RMDS feasibility equipment on USS JUNEAU.



Figure 6. RMDS feasibility equipment at NRMCC, San Diego.

Although this equipment was not designed for medical purposes and did not have the resolution required for acceptable diagnoses of many X-rays, it did show that the concept and the system were technically feasible and could be developed with existing state-of-the-art technology. A detailed account of this study can be found in reference 1.

Based on the results of the feasibility tests, a system design and specifications were prepared for the procurement of Advanced Development Models (ADM)s. Two RMDS ADM terminals were developed and manufactured by Colorado Video, Inc., under contract to NOSC; these units were delivered to NOSC in September 1977. An ADM terminal, with its related components, is shown in figure 7. Figure 8 shows the transmission of a patient's ECG over the RMDS ADM terminals. Figures 9 and 10 show images before and after transmission (analog and digital) over the ADM terminals via an hf radio link. These figures show the significant improvement in video resolution of digital transmissions compared to analog.

During FY 78-79, the ADM system was fully tested in the laboratory and at sea; radiology tests were conducted as well. Laboratory testing included engineering tests at NOSC to determine technical capabilities and performance of the ADM units. Operational tests were conducted at sea between the USS ENTERPRISE (CVN-65) and NOSC to determine the capabilities and performance of the ADM units in a shipboard operational environment. Finally, performance tests were conducted at the NOSC laboratory by radiologists from NRMCC, San Diego, to determine the clinical utility of the ADM units for diagnosis of radiograph images. A summary of these tests is contained in NOSC TN 668 (ref 2). Detailed results of these tests are contained in NOSC TR 683 (ref 3), NOSC TR 690 (ref 4), and NOSC TR 691 (ref 5).

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<sup>1</sup>"Resolution Requirements for Diagnosis of Transmitted Radiographs," Proceedings of the San Diego Biomedical Symposium 17, 1978, p 357-373, Crepeau, R.L., Gerber, F.H., and Rasmussen, W.T.

<sup>2</sup>NOSC TN 668, "Remote Medical Diagnosis System (RMDS) Advanced Development Model (ADM) Test and Evaluation Summary Report," April 1979, Rasmussen, W.T. and Stevens, I.

<sup>3</sup>NOSC TR 683, "Remote Medical Diagnosis System (RMDS): ADM Radiology Performance Test Results" (in process for publication).

<sup>4</sup>NOSC TR 690, "Remote Medical Diagnosis System (RMDS): ADM At-Sea Test Results" (in process for publication).

<sup>5</sup>NOSC TR 691, "Remote Medical Diagnosis System (RMDS): ADM Laboratory Test Results" (in process for publication).

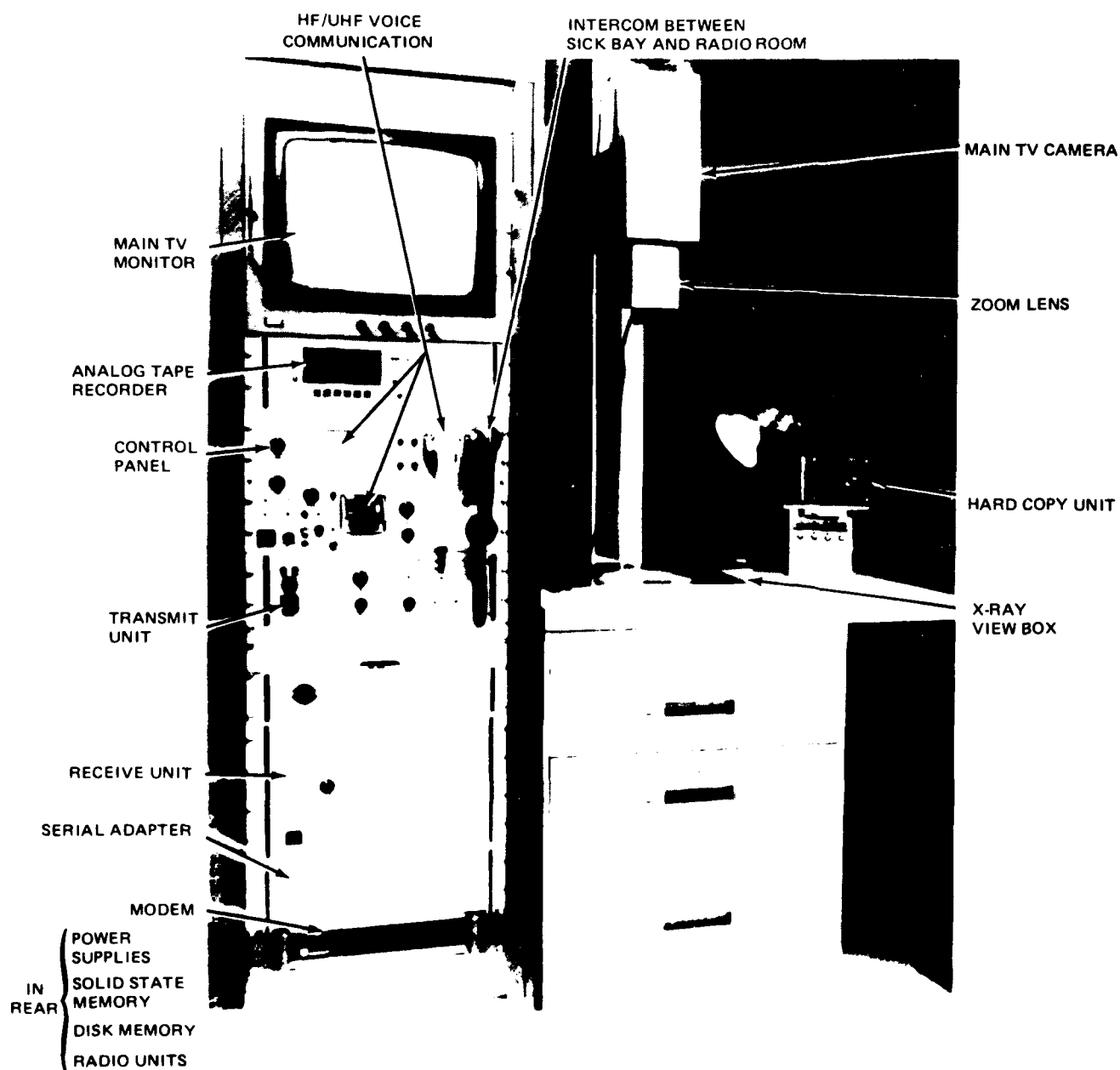


Figure 7. RMDS Advanced Development Model (ADM).

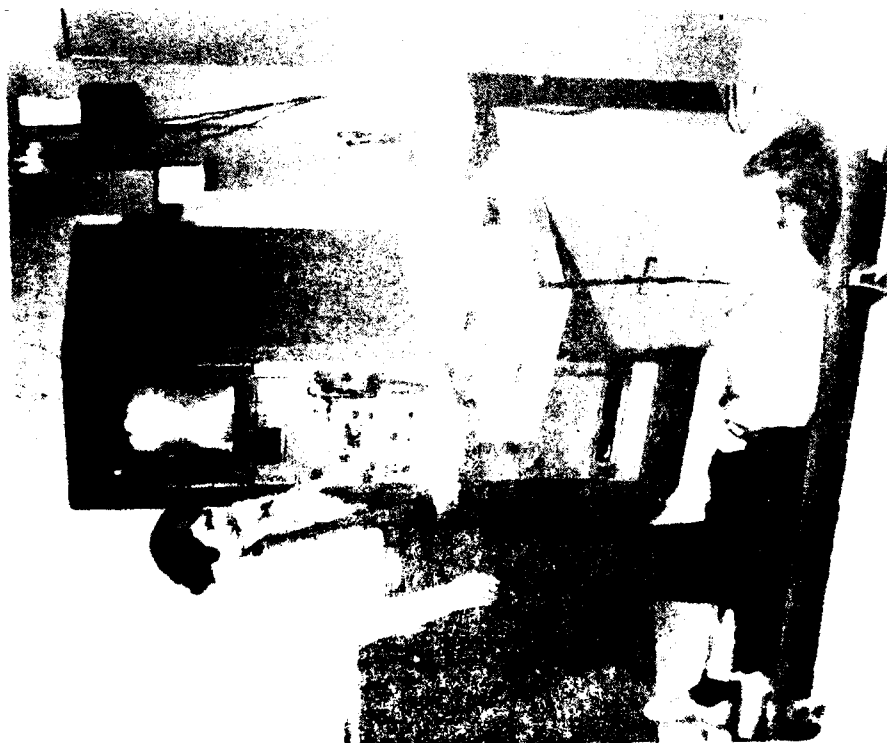
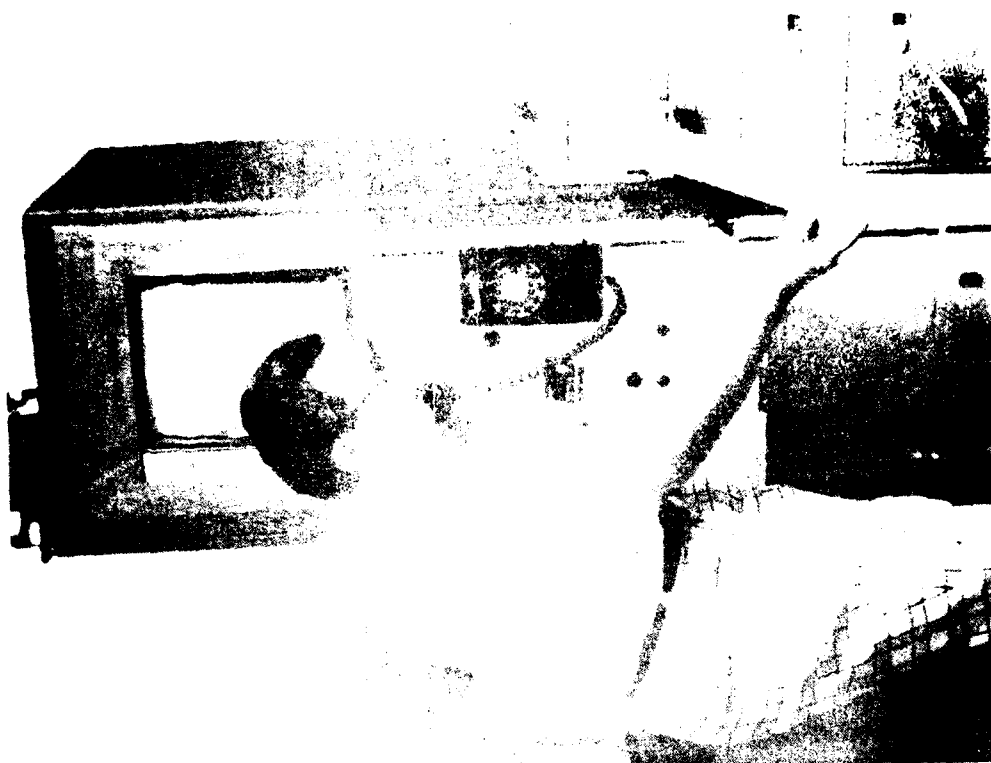


Figure 8. ECG transmission over RMDS ADM terminals.





a) At transmit terminal  
before transmission.



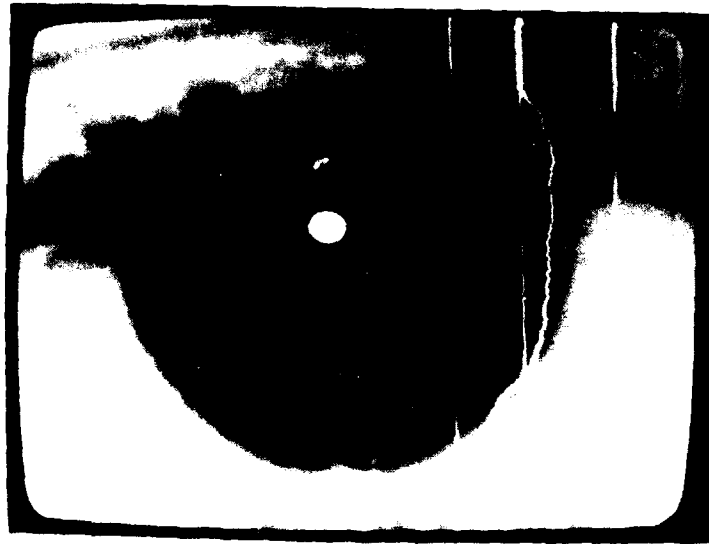
b) Received analog image.



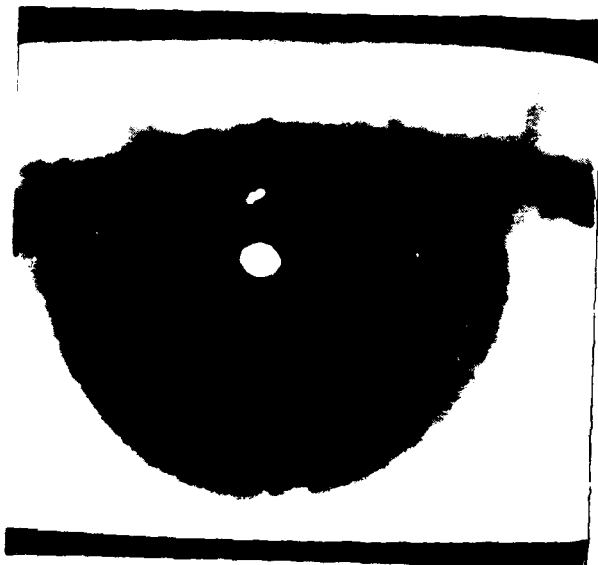
c) Received digital image.

**\*This figure has been updated to date of publication.**

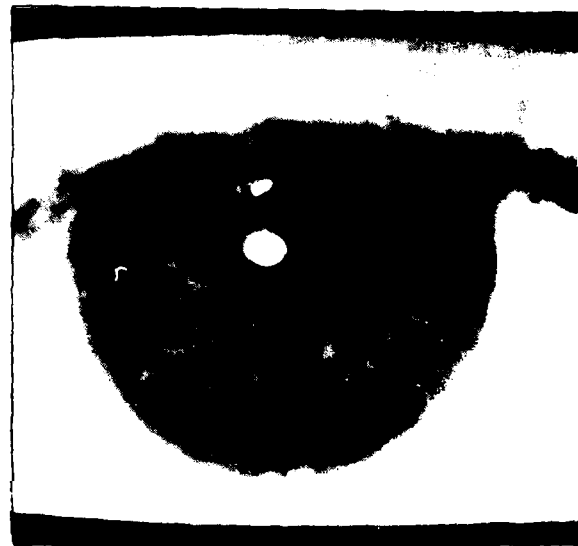
**Figure 9.\* Transmitted and received X-ray images (analog and digital) over ADM terminals via hf.**



a) At transmit terminal  
before transmission.



b) Received analog image.



c) Received digital image.

*\*This figure has been updated to date of publication.*

Figure 10.\* Transmitted and received images (analog and digital) of eye over ADM terminals via hf.

## ENGINEERING DEVELOPMENT MODELS (EDMs)

Dr. W. Rasmussen (NOSC):

Many of the technical and operational requirements for the RMDS were determined through laboratory and at-sea performance testing of the ADM terminals. A draft of system specifications for the next phase of development, Engineering Development Models (EDMs), was prepared for this design review meeting. There are several key issues in these specifications yet to be resolved; such as communication security and encryption, terminal configuration and size, and operational procedures. One of the goals of this design review meeting is to resolve these issues, or establish the activities, individuals and procedures to resolve them.

Figure 11 shows the project plan during this EDM phase. A contract award for the development of the EDMs is anticipated by August 1981. Phase I of the contract will include system hardware and software documentation development, to be completed by end of FY 82, and Phase II will involve fabrication of the terminals during FY 83. The specific steps involved in the procurement cycle, and the design and fabrication cycle, are shown in figure 12. Acceptance (first article) testing, such as reliability, shock, vibration, etc., will be performed by the contractor in FY 83, with delivery of the EDM terminals to NOSC by the end of FY 83. Shipboard TECHEVAL and OPEVAL would be scheduled for FY 84.

Figures 13 and 14 show conceptual configurations for the EDM terminals. The terminals are modular in design, with each unit (see figure 13) being a separate module. The Type I terminal, shown in figure 13, was designed for shipboard or remote clinic use. The Type II terminal (figure 14) was designed for a diagnostic center hospital. Electronically, the two types of terminals are alike. The Type I terminal will be able to either transmit or receive data. The Type II terminal will essentially be a receive terminal only and will not be provided with a camera, although electronically it would have a transmit capability. The Type II terminal will have four image monitors (two for the Type I terminal) and a mass storage unit for storage of up to 100 images. The Type I terminal will further be designed so that it can be installed in two mounting racks: one with the control/display unit which would be accessible to the medical users, and a second rack containing the electronics (data unit, voice digitizer unit, and modem unit) which could be mounted in other spaces as available on a given ship.\* Operational characteristics for the EDMs are given in figure 15.

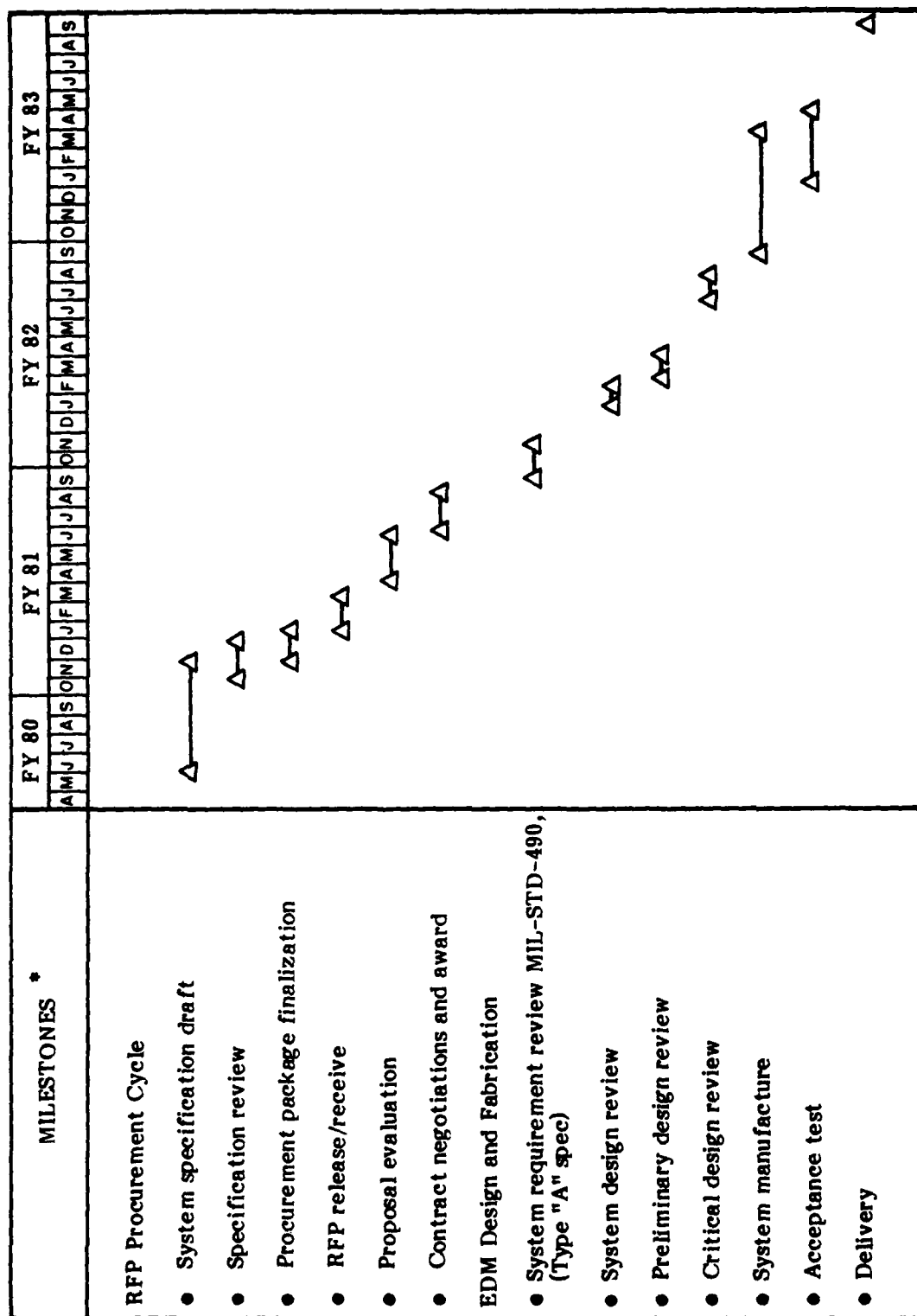
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\*This design concept is a result of recommendations from the design review meeting and a ship siting for space availability on small class ships (see Appendix B).

MILESTONES*	FY 80	FY 81	FY 82	FY 83	FY 84
EDM Development					
• System specification	↑				
• RFP Procurement cycle		↑			
• System hardware and software documentation development		↑	↑		
• System fabrication			↑	↑	
• Acceptance testing				↑	
• Delivery				↑	
• Shipboard TECHEVAL				Δ	↑
• Shipboard OPEVAL					↑

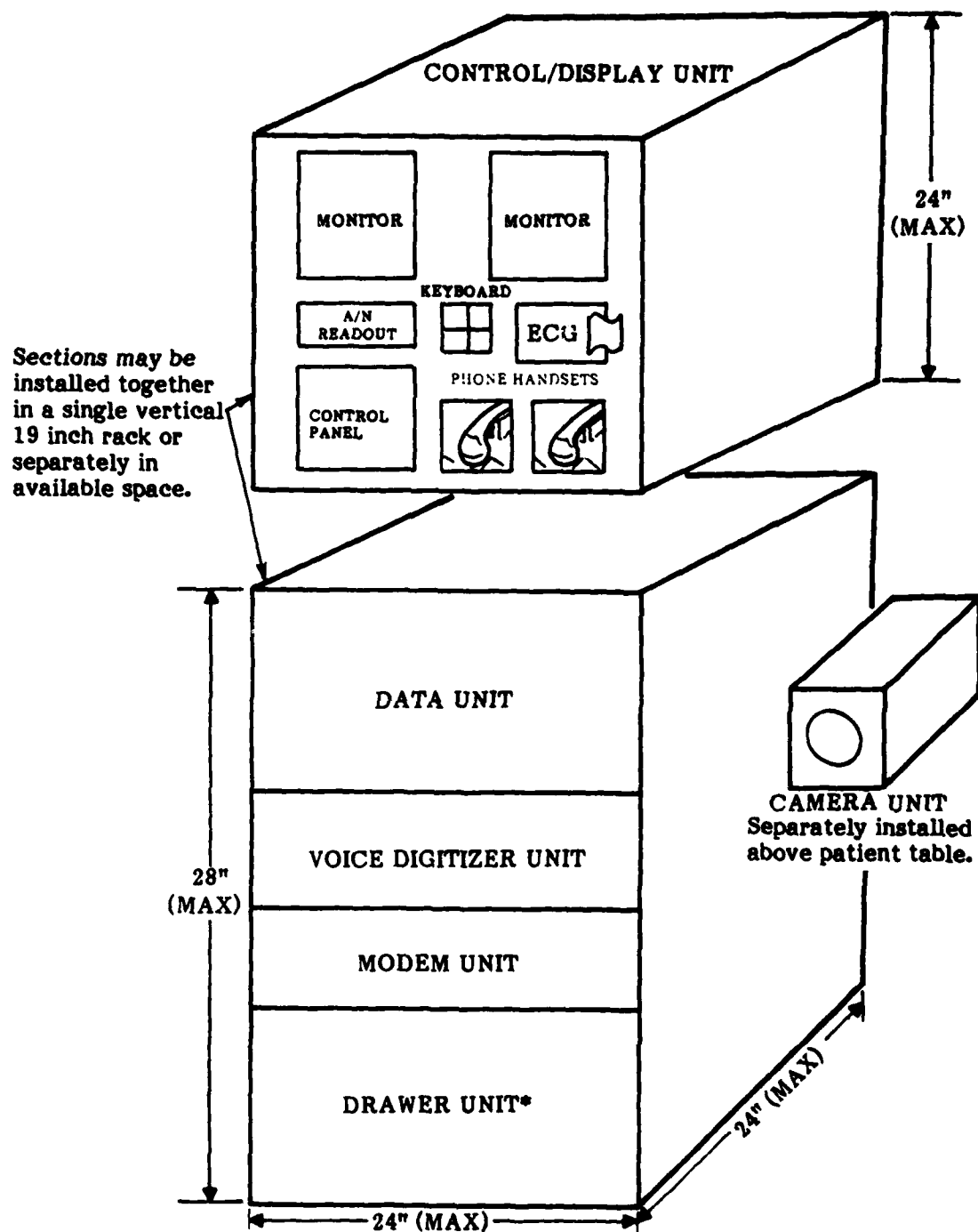
\*These data have been updated to date of publication.

Figure 11.\* Project plan.



\*These data have been updated to date of publication.

Figure 12.\* EDM procurement cycle summary.



\*To be included only if height limitation is satisfied.

Figure 13.\* Type I EDM terminal.

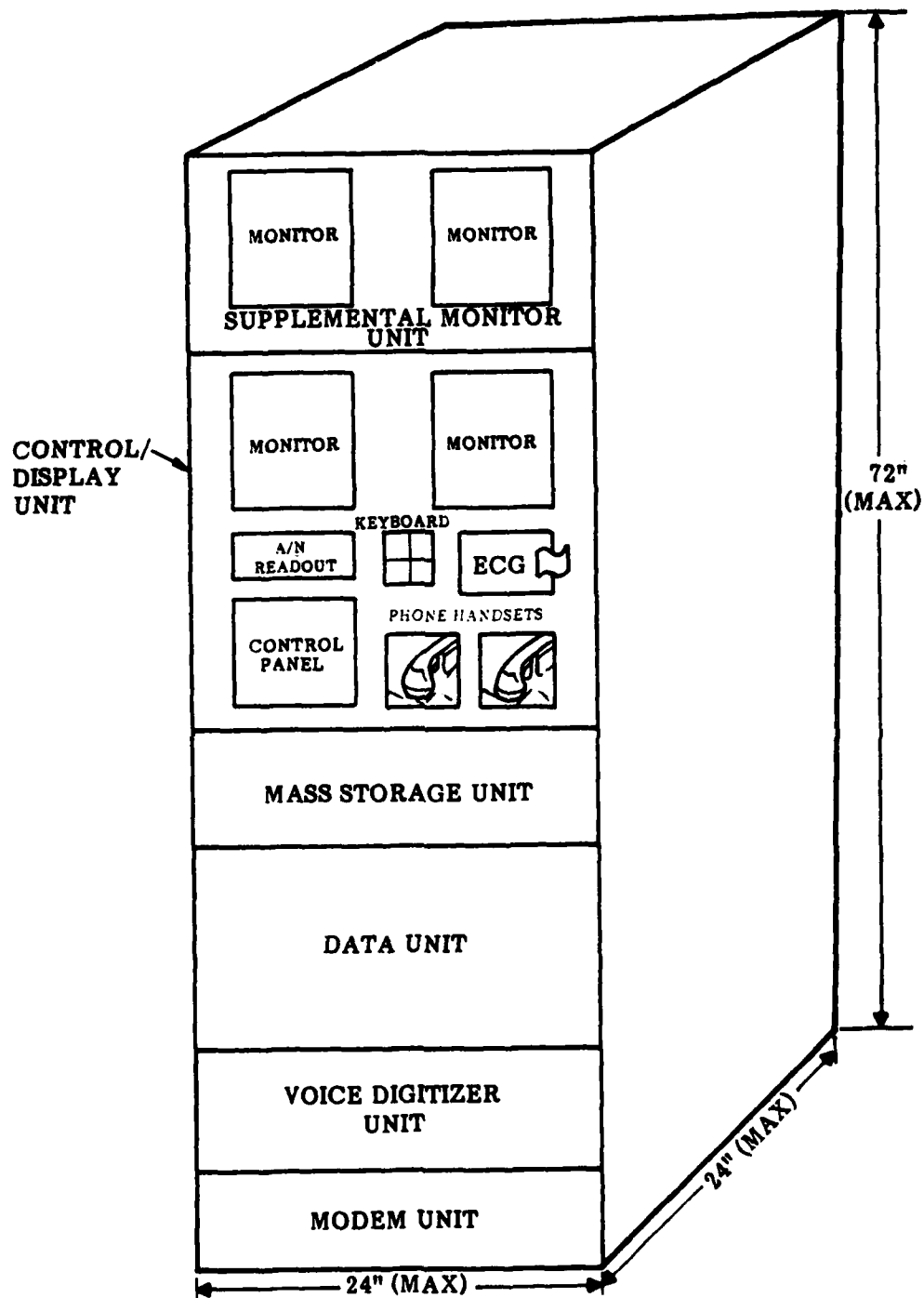


Figure 14.\* Type II EDM terminal.

# EDM OPERATIONAL CHARACTERISTICS

Operational Suitability	Thresholds	Goals
<ul style="list-style-type: none"> <li>• Reliability (T = 10 hrs mission time) (MTBF)</li> <li>• Maintainability (MTFL) (MTTR)</li> <li>• Operational Availability</li> </ul>	0.97  350 hours  15 minutes 45 minutes  0.95	0.98  500 hours  10 minutes 30 minutes  0.98

Figure 15. EDM operational characteristics.



CAPT B. Blankenship (COMSUBLANT):

Although the RMDS is feasible, is it operationally feasible, particularly for submarine use? Unless there is a way to communicate without violating security (ie, giving away position), then the system is of little use.

Dr. Silva (NOSC):

This system was never actually intended for use on submarines. There is another ongoing project at the Naval Submarine Medical Research Laboratory, New London, CT, to make use of micro-computers onboard the submarines to provide the corpsmen or physicians with computer-aided diagnoses.

CAPT Johnson (NAB, Little Creek):

It should be remembered that this program was started to get some electronic gear out in the fleet that works and which is compatible with other electronic equipment and existing communication equipment. It is conceivable, down the line, that this computer-aided diagnostic system will plug into the RMDS, but that is low in the priority of system requirements at this time.

CAPT W. Phillips (COMNAVSURFLANT):

In 4 years at COMNAVSURFLANT, I know of no cases where we have had any poor results from the actions of a corpsman.

CAPT Johnson (NAB, Little Creek):

If you can validate that within your forces, there is 100 percent satisfaction with medical capabilities and there is no loss of productivity, then there is no need for the system. But at the time of the previous studies, there were significant deficiencies, and it was felt that this was one method to address the problem. If these problems don't exist anymore, if there's no requirement for the system, that's what these people want to know.

COMMUNICATIONS AND SECURITY

I. Stevens (NOSC):

The communication links used during the at-sea tests of the ADM terminals are shown in figures 16-19. Testing between the ENTERPRISE and NOSC was done via hf radio to NAVCOMMSTA, San Diego and then forwarded via telephone line to NOSC. This was done using both analog and digital transmissions, unencrypted. Satellite links were also used in these tests, using digital encrypted transmissions. Detailed communication interfaces for these tests are shown in figures 17 and 18. Figure 19 shows the hf communication interface at the NAVCOMMSTA as originally intended and as it had to be reconfigured in order to operate properly. Because of signal feedback problems, an interface between the CSB (Command Switch Board) and the telephone lines will have to be designed as part of the RMDS equipment (ref 6).

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<sup>6</sup>NOSC TR 631, "Remote Medical Diagnosis System (RMDS): Evaluation of the AN/FTA-28 Telephone Terminal Interface," Dec 1980, Rasmussen, W.T., Stevens, I., and West, J.

# ADM COMMUNICATION TEST LINKS

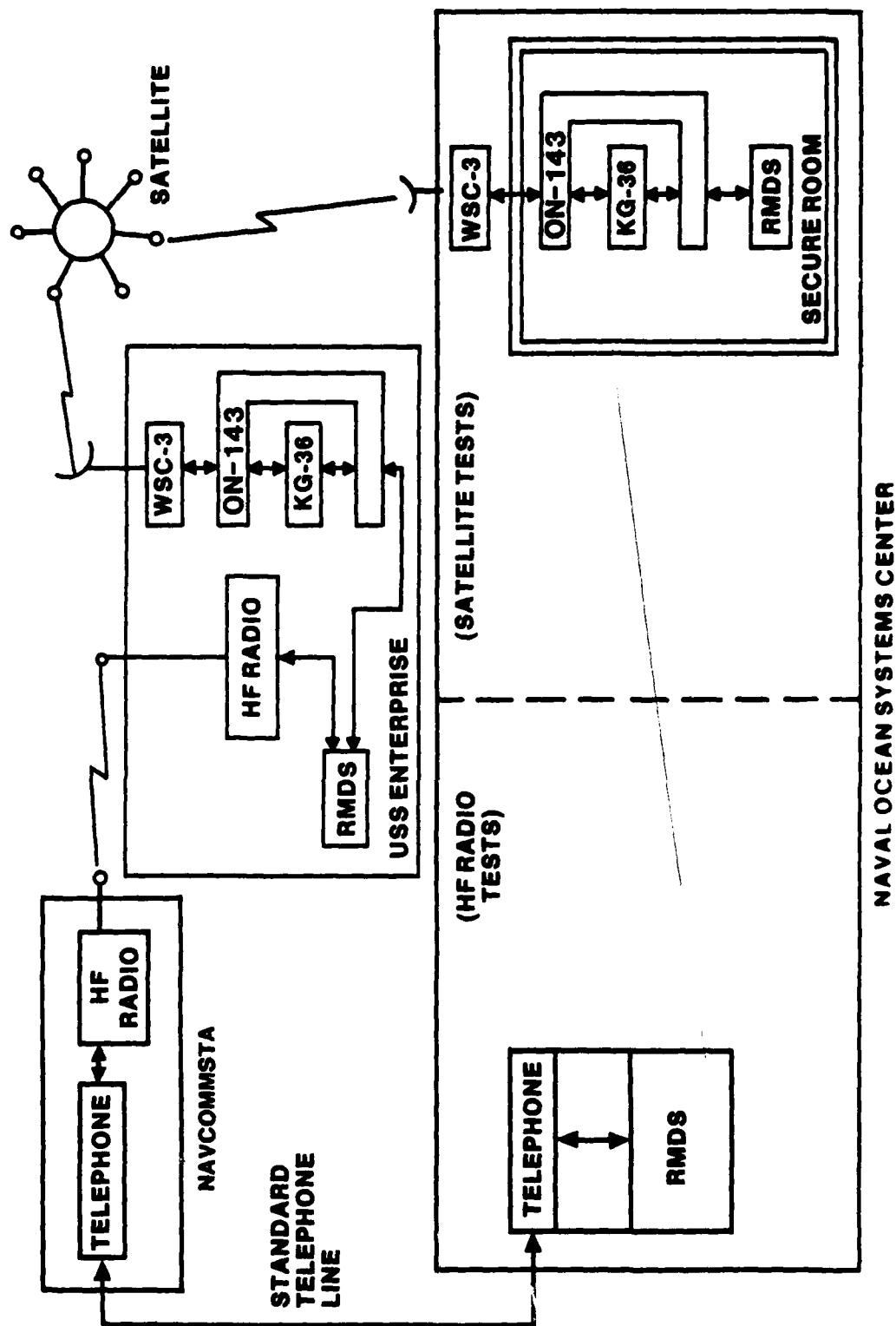


Figure 16. ADM communication test links.

# ADM TEST INTERFACE ABOARD THE USS ENTERPRISE

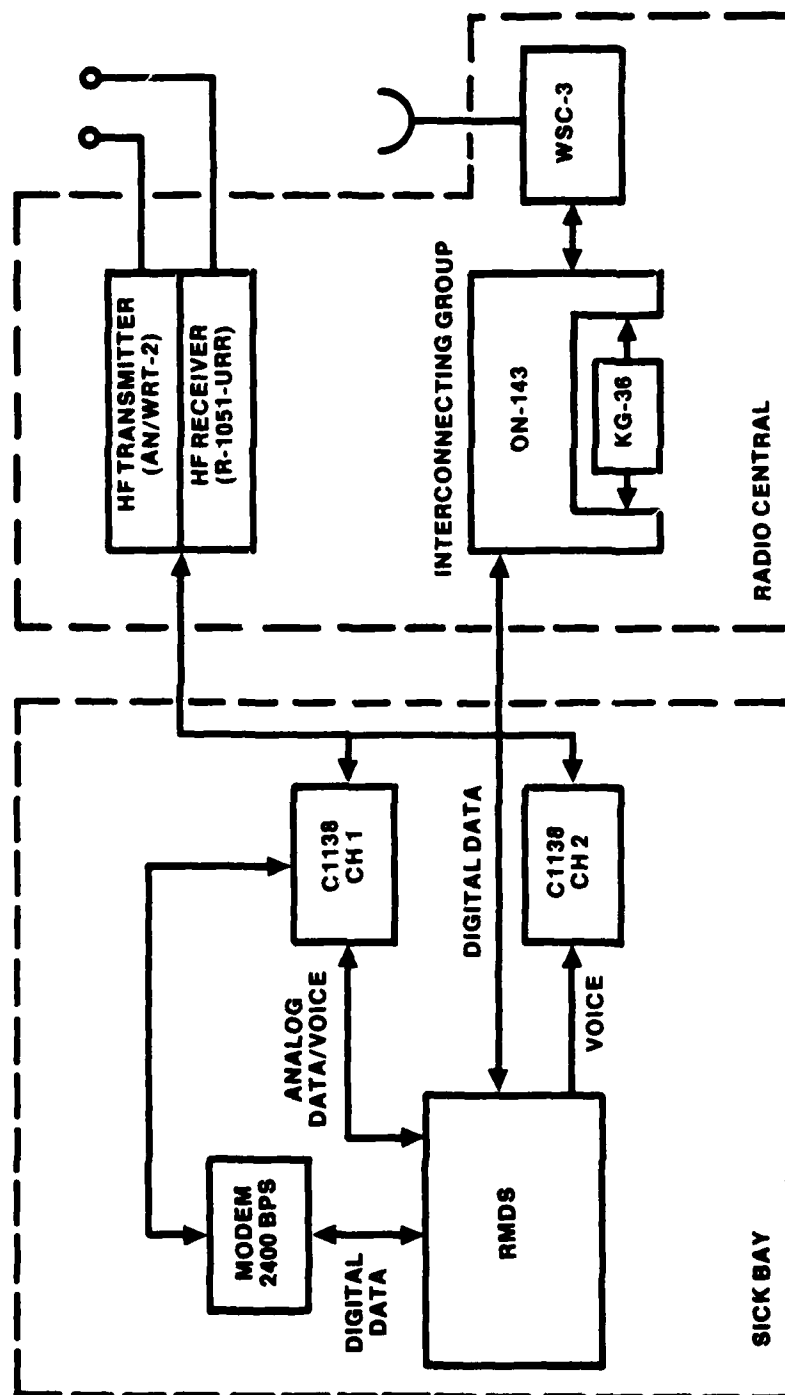


Figure 17. ADM test interface aboard the USS ENTERPRISE.

# ADM SATELLITE INTERFACE AT NOSC

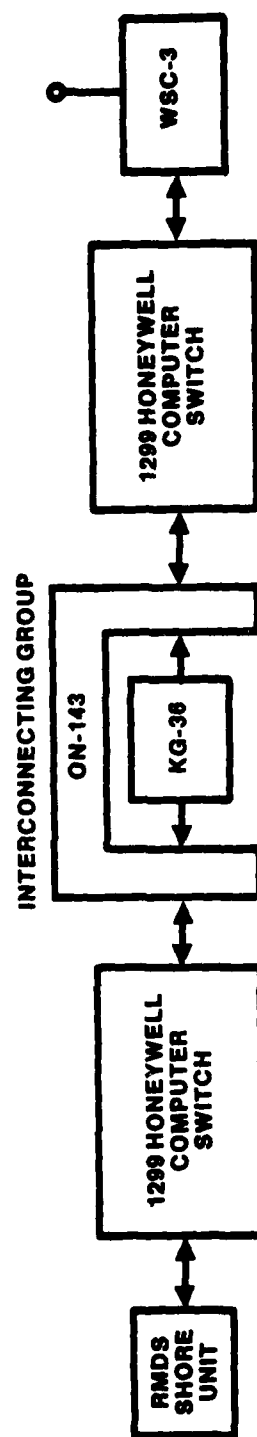


Figure 18. ADM satellite interface at NOSC.

# NAVCOMMSTA ADM INTERFACE

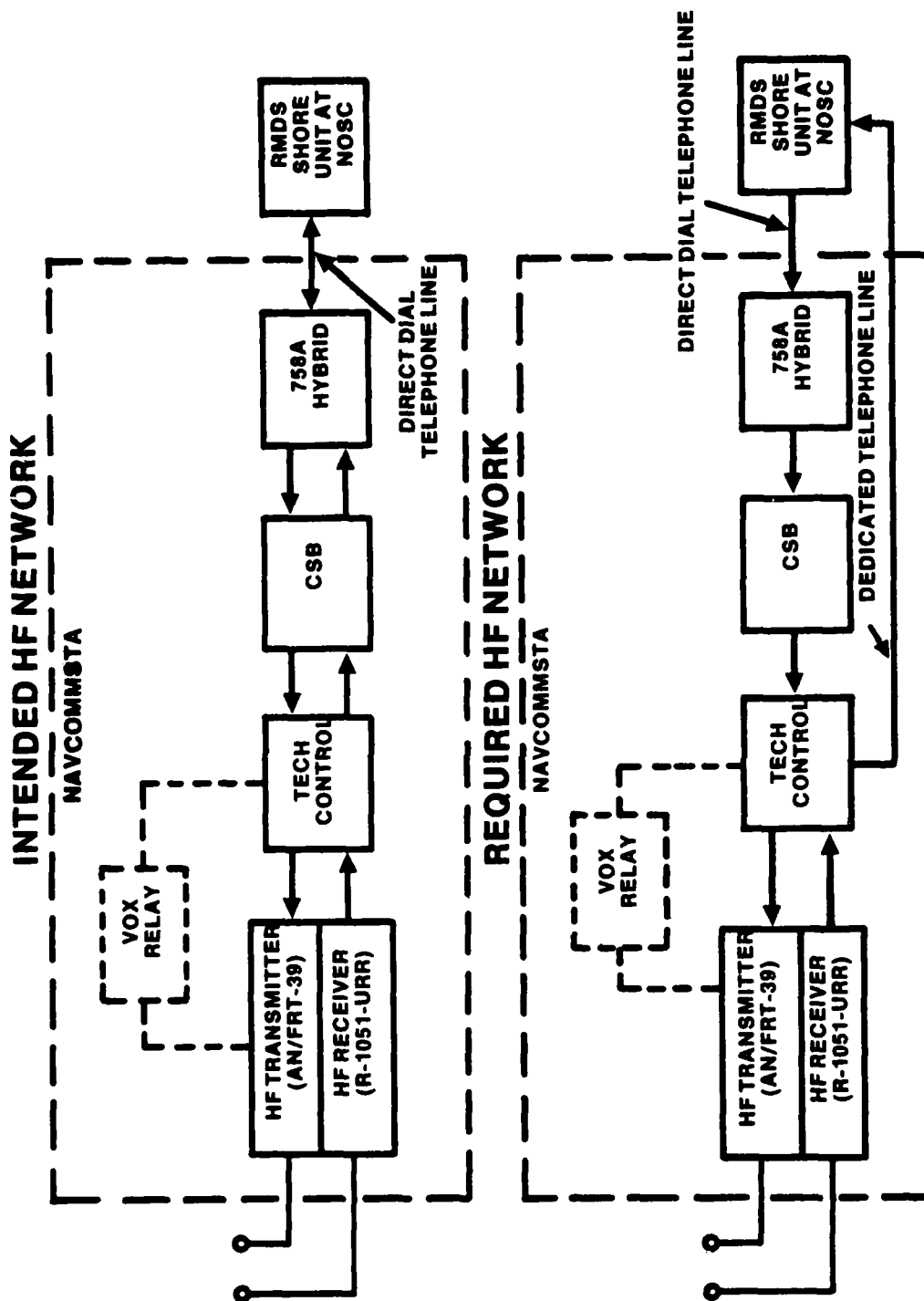


Figure 19. NAVCOMMSTA ADM interface.

Figures 20 to 23\* represent proposed communication links for the EDMs. Ship-to-ship hf/uhf communications (analog or digital) are proposed to be transmitted unencrypted (figure 20). Ship-to-shore hf links, again unencrypted, would be transmitted via a NAVCOMMSTA and patched by telephone line to an NRMC as shown in figure 21. Figures 22 and 23 represent a satellite link from a ship to a SATCOM, linked via telephone to an NRMC. In both cases, the data is encrypted over the satellite; but the data may be decrypted either at the hospital (figure 22) or at the SATCOM and then passed unencrypted to the hospital (figure 23). If RMDS data is to be considered classified, it would have to be encrypted as in figure 22, or it could possibly be relayed on covered lines even in the case of figure 23. If encryption equipment were to be required at the hospital, they may impose severe operational constraints on the use of the system.

C. Eighmey (NAVSECGRUCOM):

By 1985, all DOD shore communication networks are scheduled to be on a secure telephone system (the STU-2). This system should be able to handle the secure link between the SATCOM and a Naval hospital. This line may have to be an additionally leased line for RMDS use. (See Appendix A.)

G. Williams (NAVTELCOM):

In the future, all communications to and from Navy ships are to be encrypted, and, in particular, this applies to any satellite communications. So your system must be designed to conform to that requirement.

R. Benson (NAVELEXSYSENGCEN):

Encryption equipment will have to be located in separate areas from the RMDS equipment, ie, in secure communication areas either onboard ship or at SATCOMs or COMMSTAs ashore. The link from the RMDS terminal to the encryption equipment can be secure with use of an approved low-level secure phone.

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\*These figures have been updated to reflect the information obtained from the design review meeting and follow-on discussions.

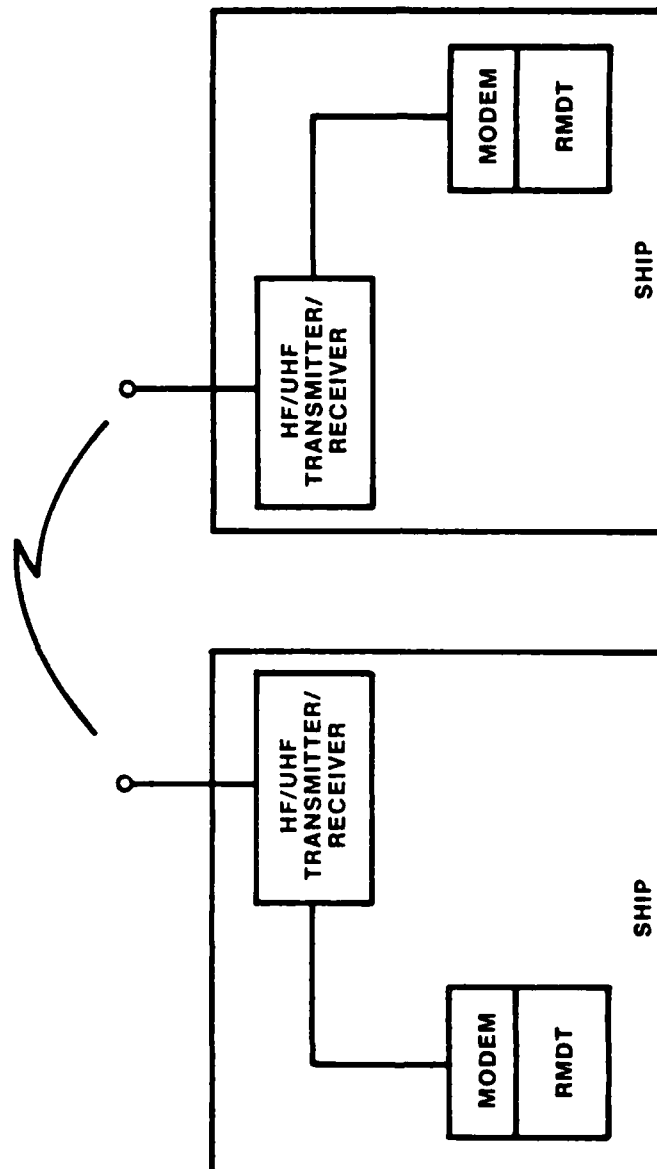


Figure 20. HF/UHF ship-to-ship communication link for EDM.

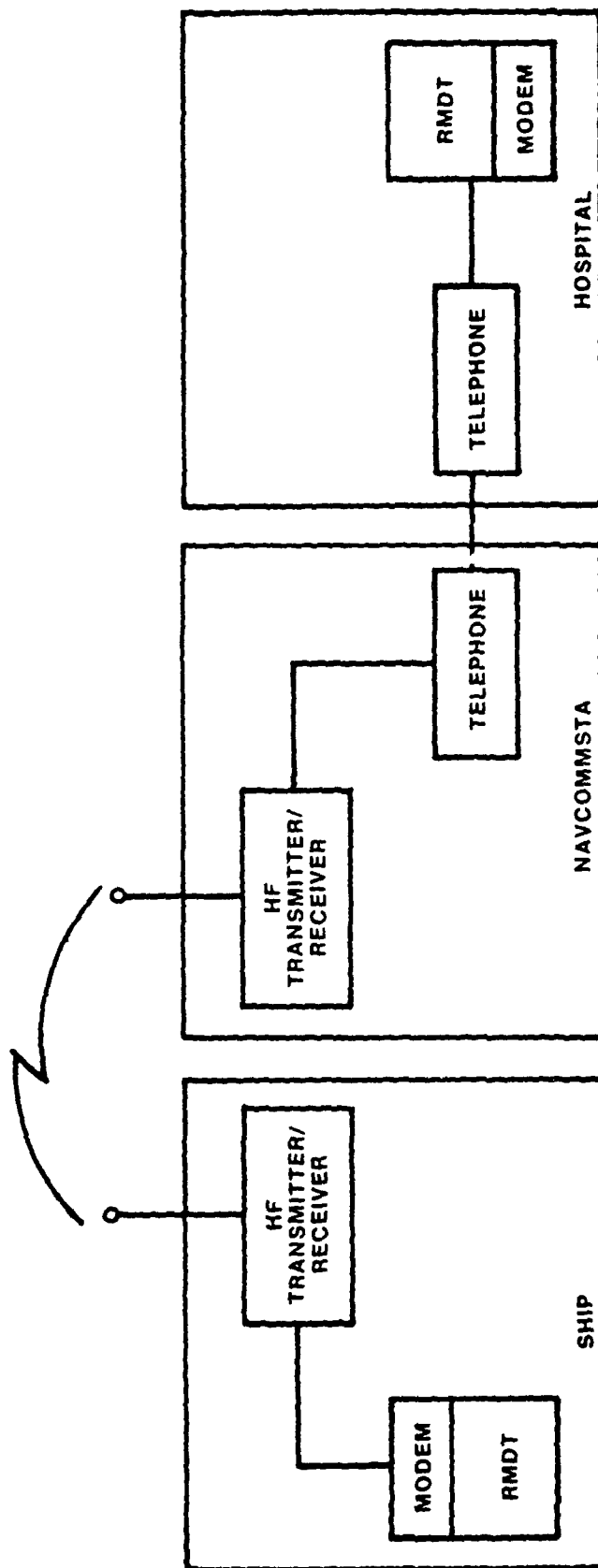


Figure 21. HF ship-to-shore communication link for EDM.



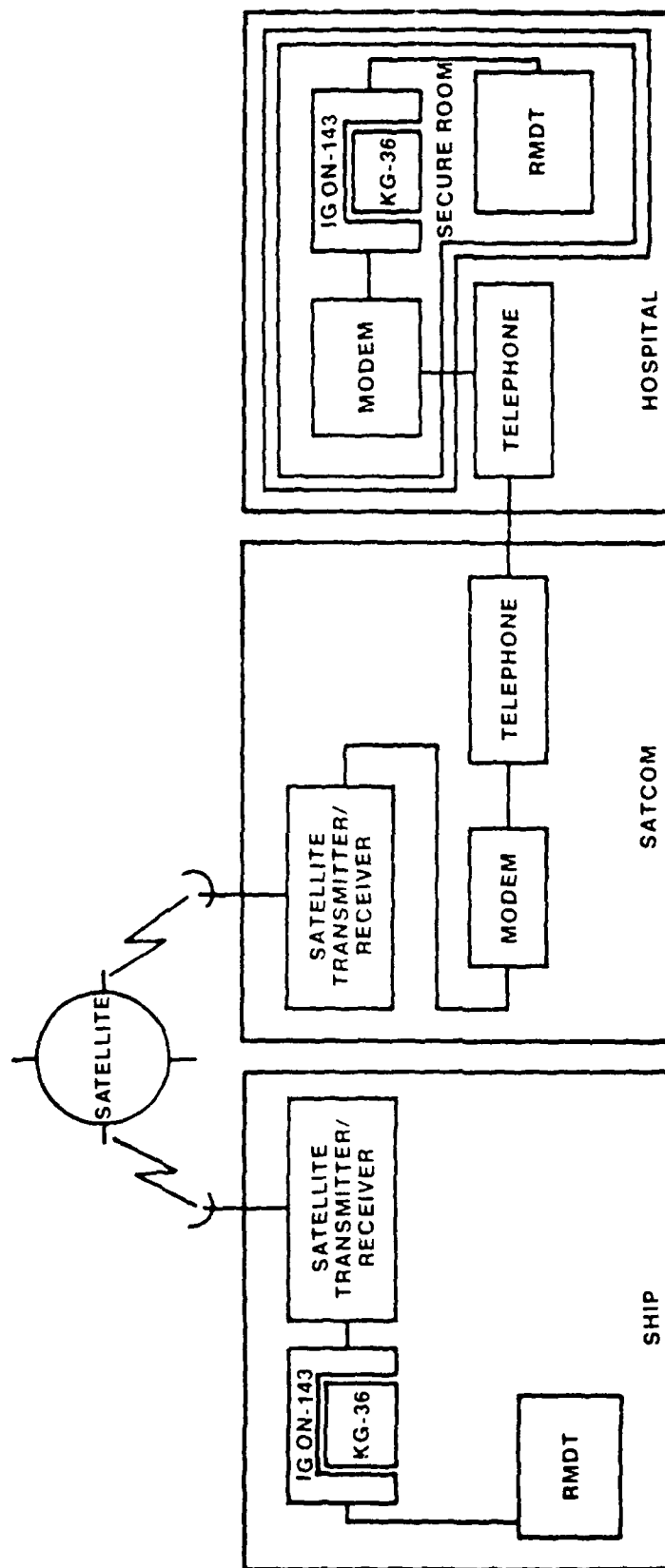


Figure 22. Satellite ship-to-shore communication link for EDM (classified data).

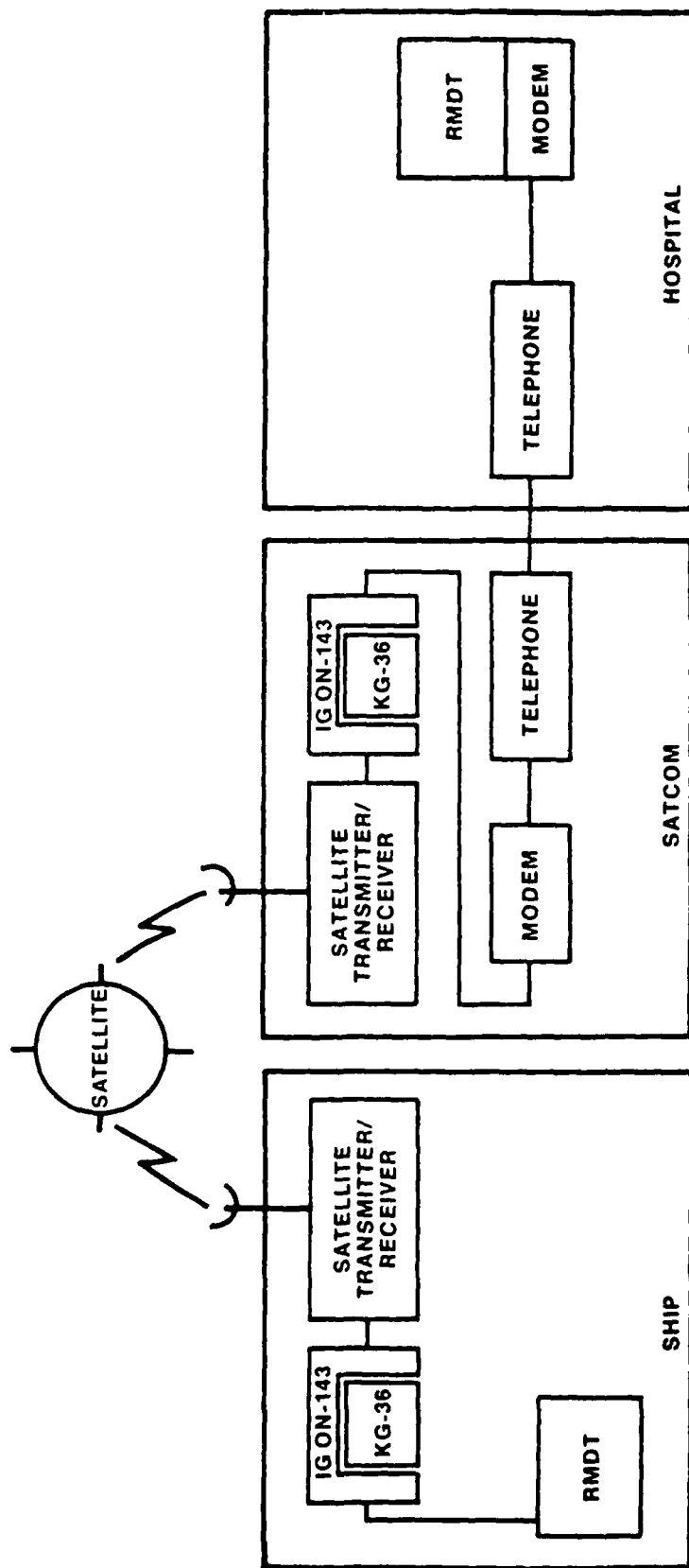


Figure 23. Satellite ship-to-shore communication link for EDM (unclassified data).

## USER INPUTS

### CAPT Phillips (COMNAVSURFLANT):

When you tested this system on the ENTERPRISE, how long was the average amount of communication time involved in resolving a medical case?

### Dr. Rasmussen (NOSC):

During the testing on the ENTERPRISE, the RMDS was not used by the medical department; it was only technically tested by NOSC engineers. Test periods were set up for 2- to 4-hour periods, during which time several video images and ECGs were transmitted, and other engineering tests performed.

### CAPT Phillips (COMNAVSURFLANT):

It's important to know what the average length of time for a single case might be expected to be.

### CAPT Blankenship (COMSUBLANT):

In a test in February 1980, an ECG was transmitted from a submerged submarine, over the satellite to CINCLANTFLT, and then by phone line to the Cardiology Department at NRMC, Portsmouth. The whole process took 4 minutes.

### I. Stevens (NOSC):

That's one aspect of the RMDS; ECG transmissions are done real-time, ie, it is received and recorded on an ECG strip chart simultaneously at the receive end. A physician can receive as much of an ECG as is wanted.

A video image presently takes a fixed amount of time. A full resolution image of 512 lines by 256 pixels by 6 bits takes about 6 minutes to transmit in the digital mode at 2400 bits/second; half resolution will take half that time. This is without any compression techniques; with 2-to-1 or 3-to-1 compression, it will be possible to transmit in 2 to 3 minutes. It may even be possible to compress this more and thus reduce the time more.

A more time-consuming problem is usually the amount of time required to establish the communication links. Once these are established and the medical data (video image, ECG, test reports, etc.) are transferred, the corpsman/physician may want further discussions with the consultant.

### CAPT Phillips (COMNAVSURFLANT):

Is the video image transmission of an X-ray of sufficient quality to be able to make a diagnosis?

CAPT Blais (BUMED):

When in San Diego about a year ago, we transmitted (over phone lines) a close-up image of the eye showing only the iris (using a zoom lens). While viewing only the received image in another room, I could see the ridges on the anterior surface of the iris. This was of sufficient detail to make many ophthalmological diagnoses. On an X-ray showing a small bone cyst, it was possible to see it on the full size transmission; in a zoom close-up, it was possible to see sharp detail of the bone cyst.

The radiology study which was performed with the present Advanced Development Models by radiologists at NRMCC, San Diego, showed that they were able to make acceptable radiographic diagnoses using this system (ref 7).

I. Stevens (NOSC):

Although the transmissions that CAPT Blais saw were only transmitted over a phone line, if a reasonably good hf/uhf link is established or a satellite link used, the received images will be of the same quality when digital transmissions are used.

CAPT Ireland (OP-098E):

The time sharing and average amount of time required, for a general case, will be addressed and resolved. The training and use of the system will be an important factor, and will be addressed in the appropriate place.

We now have the documentation base resolved for the development of RMDS, and we have no problems at CNO with the documentation base. We feel the operational requirement has been established by the fleet, and OP-098 wants to see this project move on. This meeting should simply be to resolve Test and Evaluation technical issues.

CAPT Blais (BUMED):

At the outset of the project, during the conceptual phase, did we ever go to the CINCs to request their inputs: should the system be made operational, etc.?

CAPT Johnson (NAB, Little Creek):

The original feasibility tests were passed to the CINCs for approval as a matter of standard procedure. The Force Medical Officer agreed at that time that this was a legitimate operational requirement, warranting an OPEVAL feasibility. CINCPAC has been aware of the program from the very beginning, especially since they were involved in the feasibility tests.

CDR J. Bates (NMRDC):

Part of the reason for some of the delay (during FY 78-80) discussed earlier, was that in FY 79 this project was still being funded out of Advanced Development dollars, and there just wasn't enough money to support it along with the other projects that belonged in the 6.3 research area. We had been asking for 6.4 money for the previous two years,

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<sup>7</sup> NOSC TR 683, "Remote Medical Diagnosis System (RMDS): ADM Radiology Performance Test Results" (in process for publication).

and had to go to Congress to justify it; we finally received 6.4 funding for FY 80. This was part of the reason for the slowdown between FY 78-80. Was there any previous planning for procurement funding?

CAPT Johnson (NAB, Little Creek):

During the reorganization of the Research Command (Naval Medical Research and Development Command) this project was one of about \$1.5 million of annual research that addressed one operational requirement. This funding came from 6.2 and 6.3 research; 6.4 funds were not available. In 1975, this project was included in the Communications Command budget for 6.4 and 6.5 dollars in 1979, 1980, and 1981. In fact, this system was made a qualifying requirement for the existence of the satellite; it was a line item as one of the justifications for the purchase of the satellites. It was a CNO approved operational requirement confirmed by both CINCs. At that time, part of the 6.4 and 6.5 money (for FY 79-81) was to come from the Communications Command.

Dr. Silva (NOSC):

We had always understood that we were working with an established operational requirement. However, again, as last year, we seem to be asking the question of whether or not we want to have an RMDS, rather than what form it should take, and how to get the necessary documentation and plans for future implementation. Our understanding was that the operational requirement question was settled.

CAPT Ireland (OP-098E):

We do have an established Operational Requirement according to OPNAV directives.

CAPT H. Rudolph (NAVMEDMATSUPCOM):

Rather than discussing the question of whether or not we need an RMDS, maybe we should be looking at the feasibility of developing a more sophisticated, completely self-contained system that wouldn't require any communications off the ship.

CAPT Ireland (OP-098E):

There are other shipboard systems being looked at, including the automated diagnostic system. What we're looking at is a 5-year development plan; it's possible to continuously change the system design, but at some point in time it's necessary to implement a system.

CDR Bates (NMRDC):

It is possible in the future that several of these projects and resulting systems will be able to be tied together. In fact, RMDS may be the hub of these various systems, but that will have to be looked at carefully. In the meantime, we need to continue with the RMDS rather than wait for some eventual possibility, or it may never happen.

CAPT W. Milroy (COMSUBPAC):

Ultimately, this whole system will depend on the doctor who is at the receiving end. Right now, a well-trained independent duty corpsman on the ship can make a better medical operational decision than a "randomly selected" intern in an emergency room at some hospital who may happen to respond to the medical diagnostic request.

Dr. Silva (NOSC):

That may be true, but that is a procedural problem, not a technical problem. If proper procedures are followed, a well-qualified specialist (at a shore hospital) or a physician on another ship would be at the receiving end, not some "randomly selected" intern.

CAPT Johnson (NAB, Little Creek):

Consider an existing example. Presently on the LHAs there are easily a half million dollars worth of medical equipment that nobody uses. Does that mean we should take it off? No, because that is our only link to good combat casualty care.

We should have no objections to breaking through the barrier to establish a communication link between the medical department afloat and the rest of the Navy medical department.

CAPT Blais (BUMED):

Described the system similar to our RMDS equipment which is presently being used in Ontario Province, Canada, between two major hospitals (Toronto), small hospitals in surrounding areas, nurse manned clinics in smaller towns outside of Toronto, and some remote villages in far northern regions of Canada. Their clinical experiences with this type system have proven to be very successful and cost effective. The system is utilized not only for diagnosis and treatment, but also for medical education.

CAPT Phillips (COMNAVSURFLANT):

We have heard that the clinical testing of the RMDS at NRMC, San Diego, was not successful because the system was down more than it was up, and the resolution was poor.

Dr. Rasmussen (NOSC):

That clinical use of RMDS was with the first RMDS equipment which had been used during the Feasibility Tests in 1975-76. That equipment was never designed for medical use, but was off-the-shelf, slow-scan TV equipment which was readily available, could be obtained within the budget at that time, and could be modified for shipboard testing. The Feasibility Tests of 75-76 showed that the RMDS concept was technically feasible, but that the equipment utilized in the tests would need to be technically improved; specifically, it needed increased resolution and reliability. However, even with this limited equipment, it was shown that proper diagnoses could be made a large percentage of the time.

Following the feasibility tests, we were requested by ADM Arentzen (then CO at NRMCC, San Diego) to place one of the units at the dispensary on San Clemente Island to help the hospital provide diagnostic consultation. NRMCC, San Diego already had a unit in their emergency room as part of the feasibility tests. A unit was installed at San Clemente Island, the phone line interface problems were solved, and the system was operational. During the 18 to 24 months that the system was there, there was only one technical problem that we know of, and any periodic testing of the system was always acceptable.

The downfall of the system at San Clemente Island was the lack of operator acceptance. Here was a situation where a system was simply brought in and the users were told to use it ... "it will help you." No indoctrination or training was given, and, as a result, their attitudes were basically negative. They felt that they could adequately do their jobs without having someone else tell them what to do. For these reasons, they did not view the equipment as another medical tool with which they could obtain additional diagnostic information or consultation. Compounding this was the problem that the equipment, pieced together as it had been, was awkward and confusing to use. As a result, the system at San Clemente Island was not used clinically for a single case during an 18-month period. (This same negative attitude was reflected by the nurses in the clinics in the Province of Ontario, Canada. However, after a year of working with the system, these nurses now refuse to work where there is no remote system.)

In contrast to this, at about the same time that the equipment was placed at San Clemente Island (September-October 1977), we received a request from the Commanding Officer at the Naval Hospital, Port Hueneme, to place a unit at their hospital and dispensary on San Nicolas Island. In this case, the corpsman at the dispensary had initiated the request. During the same time period that the system at San Clemente Island was not used, the system between San Nicolas Island and Port Hueneme was utilized four to eight times a month. Some of this use consisted of sending ECGs to Port Hueneme for annual physical exams of personnel at San Nicolas Island who would otherwise have had to schedule these exams at Port Hueneme, either on a day off or on time off from work. Other uses were documented in cases where emergency air evacuation at nighttime was avoided because enough information was available through the RMDS to make a decision to hold the patient for the next available flight. This system is still in use at San Nicolas Island, but is now supported by NRMCC, Long Beach.

These two examples point out that another very important factor in the RMDS program plans is the proper training and indoctrination of personnel in the system before its scheduled implementation. This includes adequate public relations for the program and the system capabilities.

#### CAPT Blankenship (COMSUBLANT):

The year before last, there were 39 medivacs from submarines in the Atlantic Fleet. Last year this was reduced to 14. The cost of these medivacs is estimated to be at \$100,000 each; some of them at \$200,000-\$300,000. They too have lost personnel during a medivac. They are trying everything they can to reduce the number of medivacs.

Of course, any such communication for a medivac from a submarine compromises the ship's location, and it is then removed from deployment.

The RMDS, as designed, is not practical for use on submarines because of its size and no foreseeable need to transmit video images. It is possible for them to transmit ECGs, similar to the way RMDS does, but since they do not have any X-ray equipment, they see no need for video transmissions.

An additional concern is that during a wartime situation, this system would not be of any use because of the restrictions on radio communications.

If the RMDS equipment could be designed into a very small package (a single portable module), and could communicate without violating their security, they would want it for submarine use; however, at present COMSUBLANT does not recommend test and evaluation of the RMDS in the Submarine Force.

CAPT Johnson (NAB, Little Creek):

Pointed out that any time they (submarines) presently communicate for any medical advice, or transmit an ECG as they have shown they can do, they have compromised their security and are thus removed from station. So the RMDS would be no different in that respect. Further, during a war, none of our other communications equipment would be of much use, but we don't get rid of it just because of that possibility.

CAPT Milroy (COMSUBPAC):

The system may have potential use for submarines, but, as presently designed, it is not compatible with submarines because of size.

Anything that helps the corpsmen to provide good medical care and to make good medical decisions is desirable. However, I am somewhat concerned about anything that would take away or reduce the corpsmen's capabilities to function independently when required to do so.

CAPT Phillips (COMNAVSURFLANT):

COMNAVSURFLANT has no objections to the RMDS, but does have some concerns:

1. The availability of communications time for RMDS use; when the DAMA system is available, then the RMDS will become more feasible.
2. Maintenance - no additional responsibilities are to be added to the duties of the corpsmen. (It was pointed out that the maintenance plan does not call for any such responsibilities on the corpsmen; this will be handled by ETs.)
3. Space - there are severe space limitations on all the smaller ships, and on many of the larger ships as well.
4. Ship alterations will be required in order to install the system on most ships. (Was pointed out that future planning for ship alts was part of the reason for this meeting.)



LCDR J. Baldwin (COMOPTEVFOR):

OPTEVFOR's function is to test and evaluate the operational use of a system as a whole. That means end-to-end use including users (corpsmen and physicians), RMDS terminals, communication links, maintenance, and repairs.

In order to test the whole system operationally, OPTEVFOR requests that there should be at least three terminals in the proposed network: one on a small ship, one on a large ship, and one at a Navy hospital. One of the system requirements is from the medical personnel's viewpoint. What is an acceptable amount of time to establish a communication link, and what is the turnaround time for a response? If this can't be met operationally, then the system may not meet its goals.

Meeting Adjourned At 1630 Until Following Morning

THURSDAY 28 AUGUST 1980; 0830

## FUNDING RESPONSIBILITIES

### CAPT Johnson (NAB, Little Creek):

Who will be in charge of getting the ship alts into the planning stage? If this is planned for a Class K\* alt, it may get done; but, if it goes as a Class D alt, it won't get through.

### CAPT Blais (BUMED):

LCDR R. Schockley, MSC, USN, will be the contact for the ship alts. He is liaison between BUMED (MED-3C31) and NAVSEA. He is the medical representative at NAVSEA, and is responsible for medical spaces and equipment.

### LT Swafford (BUMED):

Who is going to have the funding responsibility for the system? If it's a Class K alt, then BUMED wouldn't have any funding responsibility; it would not come from medical equipment funds. The present arrangements with NAVSEA for major investment of equipment is that if it's a Class K, they pick up the bill. BUMED is not funding equipment for Class K ship alts.

### CAPT Blais (BUMED):

RMDS is now an OP-093 sponsored program, and OP-093 will probably be responsible for planning; RMDS will mostly likely be part of the OP-093 sponsored program budget. This is based on the fact that the NDCP was signed by OP-093. No longer will we have to budget for funds through another sponsor.

### CAPT Ireland (OP-098E):

OP-093 will manage the transition from the RDT&E stage, which will terminate when we're through with the evaluation, into the procurement stage, and plan for funding from the appropriate source. OP-093 will have to be responsible for planning this program into the POM for 1984, which means it will have to be done right away. It should also be included in an SPP (Sponsor Program Proposal) as soon as possible. CDR Bates has already been requested to provide some data for this. This task should probably have a number one priority. OP-093 will take the responsibility to develop the SPP and follow-on budget plans.

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\*A Class K alteration is generated and funded by NAVSEA and effects a change for all ships. A Class D alteration, for a specific class ship, is generated by the Force Type Command.

COMMUNICATIONS AND SECURITY  
(See Appendix A also)

C. Eighmey (NAVSECGRUCOM):

The STU-2 (Secure Telephone Unit-2) will be available by 1987-88, and will be effective on all Autovon but not on commercial lines. As soon as the STU-2 is used, the Autovon line will be secure; it will be handled from a master switch, with no crypto gear at the user sites.

If you encrypt over a satellite link, it has to be encrypted from the ship all the way to the receive site. It can't be decrypted at a SATCOM and then be passed on a telephone line to a hospital. This can lead to a compromise of the encryption key.

All communications over the satellite are to be encrypted, regardless of the data being classified or unclassified. Also, there is a concern that if a corpsman were using RMDS to communicate to a hospital, classified information, such as the ship's position or schedule, might be divulged.

I. Stevens (NOSC):

One requirement will be that the data will have to be encrypted if it goes over the satellite. Can the data then be decrypted at a SATCOM and passed to the hospital over a secure phone like the STU-2?

C. Eighmey (NAVSECGRUCOM):

Yes, but the concern is that a commercial line might be used instead of the STU-2, thus compromising the crypto. Also, TEMPEST requirements will have to be satisfied for all units, and particularly the hospital units where they would be more vulnerable to radiation security leaks.

Group:

Consensus was that the RMDS network should stay within the Navy, utilizing only CONUS Navy hospitals at this time: one on the East Coast and one on the West Coast. There should be no attempt to bring in hospitals at places like Guam, Philippines, etc., where adequate professional expertise may not be available.

G. Williams (NAVTELCOM):

Dedicated, assigned radio frequencies for RMDS use should not be requested; the ship's assigned operational frequencies should be used on a Not to Interfere Basis (NIB). During any actual required use of the RMDS for a medical emergency, the ship's CO will determine the priority of use for the ship's communication equipment.

For the evaluation tests of the Engineering Development Models (EDMs), OPTEVFOR would take care of the necessary procedures for radio transmission (hf/uhf); permission for satellite testing would have to be coordinated through NAVTELCOM and OP-941E.

Smaller ships only have one ON-143 and KG-36 (encryption equipment) which are used almost full-time for required operational communications. It may be necessary to request an additional ON-143 and KG-36 for RMDS use. There will probably be a requirement for a red phone (or some secure line) between sickbay and the radio room for transmission through crypto equipment. Further information can be obtained from NAVTELCOM and NAVELEX. TEMPEST requirements will have to be satisfied on ships if data is going to be encrypted.

R. Benson (NAVELEXSYSENGCEN):

The ON-143 no longer has an automatic switching capability to switch from an incoming data line over to the VOCODER (voice digitizer) line. This has to be done manually at the ON-143. The only alternative to this would be to have our data and voice on a common input line to the ON-143; ie, the RMDS terminal would have to have its own VOCODER.

G. Williams (NAVTELCOM) and C. Eighmey (NAVSECGRUCOM):

Agreed that NAVTELCOM and NAVSECGRU, respectively, would respond officially to the communication security requirements.

CAPT Johnson (NAB, Little Creek):

If secure lines are required between the hospital and a SATCOM or COMMSTA, whose budget items should these be?

G. Williams (NAVTELCOM):

Any communication lines from a COMMSTA to a hospital will have to be paid for by BUMED. A communication plan will have to be developed and submitted to Defense Electronics Communication Office (DECO) in Illinois. They arrange for the leasing of any communication lines, which would be paid for on a monthly basis by BUMED. Commanding Officer of NAVTELCOM has stated that communication costs for RMDS will not come from their OM&N; they must come from BUMED. A communication plan with all requirements, communication network (hospitals, etc.), and data line requirements will have to be prepared and submitted to NAVTELCOM; cost estimates will have to be entered into the 1986 POM. This plan must be submitted soon.

CAPT Ireland (OP-098E):

If communication costs are going to be a part of BUMED's responsibilities, OP-093 will have to include this in their budget package.

SYSTEM SPECIFICATIONS

Militarization/Ruggedization Requirements

It was pointed out that the users usually determine what their needs and requirements are. The developing agency (NOSC) can then determine the amount of ruggedization which then goes to CHNAVMAT for modification or approval.

CAPT Johnson (NAB, Little Creek):

Strongly recommended that Class C\* shock and vibration tests, rather than Class B tests, be requested; ie, there is no need for any survivability on even a close hit.

Quality Assurance (QA)

This should be established with the help and input of NAVSEA. The actual environmental conditions must be determined, with the QA standards set against these.

System Installation

R. Benson (NAVELEXSYSENGCEN):

This will be a NAVELEX responsibility, and will need to be entered into their 5-year ship alts plans for the installation of procurement systems. COMNAVELEXSYSCOM (Code 510) will have to become officially involved before a field activity, such as Valjejo, can become active on the program.

TEST AND EVALUATION MASTER PLAN (TEMP)

CAPT Ireland (OP-098E):

There is a new instruction for Test and Evaluations dated 31 July 1980. The RMDS project will be classified within an ACAT-IV program, and will now need only a Test and Evaluation Plan (TEP), which is somewhat less comprehensive than a TEMP. The current rough draft TEMP for RMDS is probably more than is required, but they may leave it in its present form with the changes that have been recommended by OPTEVFOR. OP-098 will officially request the continued participation of OPTEVFOR for this particular task, although it is being developed within an ACAT-IV program.

LCDR Baldwin (COMOPTEVFOR):

Under the new guidelines for an ACAT-IV project, the operational testing will now become part of the shipboard technical testing, rather than completely separate testing performed at a later date. This will make the whole T&E easier to accomplish in somewhat less time. For an acceptable operational testing of the "complete system," it will be required that at least three EDMs be used (one at a hospital, one on a large ship, and one on a small ship).

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\*Class A testing is for equipment and systems considered essential for the safety and continued combat capability of the ship. Class B is for equipment and systems not required for the safety or combat capability of the ship, but to withstand shock loading so the equipment does not become adrift or create a hazard. Class C is for equipment having no shock requirements other than not to become a safety hazard. NAVSEA Publication 0910-LP-007-4100, "General Specifications for Ships of the United States Navy," 1980 Edition.

In view of the new instructions for Test and Evaluations, CNO ltr ser 987/645140 of 1 Oct 1980, COMOPTEVFOR involvement is no longer required for an ACAT-IV program. Although the requirement for COMOPTEVFOR to conduct operational test and evaluation is no longer applicable, COMOPTEVFOR will assist in program development by reviewing Naval Ocean Systems Center prepared test plans and associated documentation, and by observing system testing, as requested.

CAPT Johnson (NAB, Little Creek):

Strongly recommends using amphibious task force ships rather than a carrier and destroyer type.

Group:

Operational requirement for RMDS again questioned.

CAPT Ireland (OP-098E):

As far as CNO is concerned, the operational requirement is established and documented by the signed NDCP (#M-0933-PN).

SYSTEM DESIGN

G. Williams (NAVTELCOM):

They see no problem with the RMDS terminal design; however, they are concerned with the communication interface between the hospital and the satellite. They want to see this problem addressed separately. It needs to have a systems engineering approach to the satellite requirements for future use.

OP-986, OP-094, OP-03 (probably OP-037), and DCA should all be briefed and consulted on future communications requirements.

CAPT Johnson (NAB, Little Creek) and CAPT Phillips (COMNAVSURFLANT):

A request was recently sent to the fleet (Atlantic) asking about a requirement for a 6 ft<sup>3</sup> refrigerator. The responses were that there was not even that much space available on most ships. Space will be a critical problem for RMDS. On some of the new larger ships there might be room for the system as presently configured, or for future ship construction it will be possible to allocate space for the system once it has been approved. However, for most ships on the line today, there is no space available for the RMDS as configured.

The system must be as compact as possible. It should probably be separated into individual functional components (for example, in two or three self-contained modules), in order to take advantage of some of the unused overhead space. It should be possible to put most of the electronics modules, which will require only occasional access, in overhead space, and keep only the control module with camera, monitor, and control panel in an easily accessible area.

## LOGISTICS AND SUPPORT

### Maintenance

Medical equipment is now also included under 3-M maintenance; this will have to be addressed for RMDS. This is being handled for medical equipment in Norfolk.

Maintenance responsibilities will be assigned to electronic technicians (ETs). There may also be a requirement to include data specialists (DSs) in the Integrated Logistics Support Plan (ILSP) because of the microprocessor in the system.

### HMC Pinkerton (COMNAVSURFPAC):

Has been working on 3-M maintenance classification for NAVSURFPAC. He is being transferred to Camp Pendleton on 1 September, but will provide information to help plan 3-M maintenance for RMDS.

### Integrated Logistics Support Plan (ILSP)

The draft version of the ILSP is actually quite a bit ahead of schedule, but it's good to have it at this point in order to make updates and changes as the program progresses.

## RMDS PROJECT VISIBILITY

It was strongly recommended that appropriate public relations and briefings be conducted to adequately familiarize all potential users with the system. All appropriate RMDS documentation should be sent to all Fleet Surgeon CINCFLETS and Force Medical Officers Type Commands. There has been no dissemination of documents or information. (Appendix C is a bibliography of RMDS documents available or in progress.)

### CAPT Ireland (OP-098E):

Volunteered to help coordinate some type of article for the U.S. Navy Medicine, and more importantly, U.S. Naval Institute Proceedings (to inform the Navy Line Community).

### CAPT Blais (BUMED):

Requested that the presentation materials (vu-graphs) used for this briefing be prepared in 35mm slides, as appropriate, for briefings in the near future. Two such briefings could be held, one on the East coast and one on the West coast, for all interested personnel. Also requested that slides and photographs be prepared to show the comparison of quality between actual X-rays or other images and the digital images transmitted through the RMDS over an hf link.

RMDS Design Review Meeting Adjourned At 1300, 28 August 1980.

## SECTION 3

### CONCLUSIONS AND RECOMMENDATIONS

#### CONCLUSIONS

The following conclusions, policy decisions, or statements were made at the RMDS Design Review Meeting:

1. The RMDS would not be installed for fleet use before 1986. Consideration must be given to what the Navy's medical needs will be at that time, and how best to technically support the medical personnel in the fleet.
2. The RMDS project will require unanimous support from the medical community. BUMED fully supports the RMDS project, and as the program sponsor will pursue fleet implementation.
3. The Navy Decision Coordinating Paper (NDCP) for Medical/Dental Equipment Development #M-0933-PN (Task I - RMDS) was signed by VADM D.F. Emerson, USN (OP-098) on 25 August 1980. As far as CNO is concerned, Operational Requirements for RMDS are established with this NDCP.
4. There have been many cases of medical evacuations, both in the maritime industry and the U.S. Navy, that might have been appropriately avoided if adequate medical information could have been obtained and proper diagnoses and treatment decisions made.
5. The RMDS concept and equipment have been shown to be technically feasible. The problems to be solved now are communication and security interfaces, and operational policies.
6. The program should be limited to include only the fleet and Navy shore facilities at this time. In particular, only one major Naval Regional Medical Center (NRMC) on each coast should be considered for the shore site diagnostic centers; for example, NRMC, Oakland and NRMC, Portsmouth.
7. OP-093, as the program sponsor, will manage the transition of RMDS from the RDT&E stage into the procurement stage, and plan for funding from the appropriate source. OP-093 will be responsible for planning the RMDS program into the 1984 POM, and will include it in an SSP (Sponsor Program Proposal) as soon as possible.
8. RMDS should be planned for Class K alterations, generated and funded by NAVSEA as it effects a change for all ships. LCDR R. Schockley, MSC, USN, (BUMED-3C31) is the medical representative at NAVSEA, and is responsible for medical spaces and equipment.
9. OPTEVFOR will test and evaluate the RMDS as a whole, ie, end-to-end use; this will include users (corpsmen and physicians), RMDS terminals, communication



links, maintenance, and repairs. In order to test the whole network operationally, there should be at least three terminals in the proposed network: one on a small ship, one on a large ship, and one at a Navy hospital.

10. All fleet communications via the satellite will require encryption. Whether or not the data could be decrypted at a SATCOM and then relayed to the NRMC uncovered or on some secure phone system, will have to be decided by CNO. Other possibilities might be to require crypto equipment located at the NRMC.
11. All RMDS units, particularly the hospitals units, will have to satisfy TEMPEST requirements in accordance with the low-level emanation requirements of NSA-NACSEM 5100/5110.
12. Dedicated, assigned radio frequencies for RMDS use should not be requested for either testing of the EDMs or eventual fleet use. During the test and evaluation of the EDMs, OPTEVFOR would coordinate use of radio transmissions (hf/uhf), and use of satellite testing will be coordinated through NAVTELCOM and OP-941E. In any future fleet use, during an actual medical emergency, the ship's commanding officer would determine the priority of use for the ship's communication equipment.
13. The IG (Integrating Group) ON-143, required with the use of encryption equipment (e.g., KG-36) for satellite transmissions, cannot be automatically switched from a data line to a VOCODER (voice digitizer) line. This means that in order to utilize a VOCODER with the RMDS over satellite, the RMDS terminal will have to include its own VOCODER.
14. NAVTELCOM and NAVSECGRU will officially respond to the communication and security requirements, respectively.
15. The Quality Assurance (QA) standards should be established with the help and input of NAVSEA and NAVMAT-08D. The actual environmental conditions must be determined and the QA standards set with respect to these.
16. Installation of the RMDS terminals for fleet implementation will be a NAVELEX responsibility and will need to be included in their 5-year ship alteration plans. COMNAVELEXSYSCOM (Code 510) will have to officially include RMDS as one of its responsible projects.
17. The RMDS project will be classified as an ACAT-IV program and will only require a Test and Evaluation Plan (TEP) as opposed to the Test and Evaluation Master Plan (TEMP) as previously required. OP-098 will request continued participation of OPTEVFOR for the test and evaluation of RMDS.
18. The RMDS terminals must be designed to be as compact as possible, and preferably in modularly separable sections, so that they can be installed in available space on smaller class ships.

19. Medical equipment is included under 3-M maintenance, and this will have to be addressed for RMDS. Maintenance responsibilities will be assigned to electronic technicians (ETs); no additional maintenance load can be required of the corpsmen.

## RECOMMENDATIONS

The following recommendations were made for RMDS system design, program direction, additional data to be obtained, and program briefings.

1. OP-093 should include the RMDS in an SPP (Sponsor Program Proposal) and include the project in the 1984 POM for budget plans.
2. OP-098E should request the continued support from COMOPTEVFOR on the RMDS TECHEVAL/OPEVAL.
3. OP-098E/OP-986C should establish the encryption requirement policies for the use of RMDS over satellite or hf/uhf.
4. NMRDC should request participation of COMNAVELEXSYSCOM (Code 510) on the RMDS project.
5. A systems engineering study and analysis of the communication interface between the shore site Naval Regional Medical Center (NRMC) and the SATCOM and COMMSTA should be prepared for both the TECHEVAL and the future communication requirements. COMNAVTELCOM and DCA should be consulted on this subject.
6. A Telecommunications Service Request (TSR) must be prepared and submitted to COMNAVTELCOM.
7. A request for the use of satellite during the test and evaluation should be coordinated through COMNAVTELCOM and OP-941E.
8. Class C shock tests, requiring that no survivability be warranted even on a close hit and only that the equipment not become a safety hazard, should be recommended for the RMDS terminals.
9. Small class ships should be visited to determine space availability and installation constraints and the impact on the RMDS design (see Appendix B).
10. Consideration should be given to incorporating a capability of a digital input/output (I/O) interface between the RMDS EDM terminals and other minicomputers (e.g., TEKTRONIX 4050 series) in order to interface with potential future systems.
11. Utilization of other RMDS type systems (in civilian use, etc.) should be determined. Also, any information on the average amount of time required to resolve a case and representative types of cases should be documented.

12. Briefings/discussions of the RMDS project should be given to OP-986, OP-094, OP-037, and DCA regarding operational and communication requirements.
13. Briefings should be held for all CINCFLT Fleet Surgeons, Type Command Force Medical Officers, and other potential users to adequately familiarize them with the RMDS.
14. A set of presentation materials consisting of slides and possibly a movie should be prepared for these briefings.
15. Articles on the RMDS should be submitted to U.S. Naval Institute Proceedings and U.S. Navy Medicine.

# SECTION 4

## ATTENDEES

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J.F. Bates, CDR, MSC, USN	Code 45 Naval Medical Research & Dev. Command National Naval Medical Center Bethesda, MD 20014
A.W. Forrey, Ph.D.	Code 45 Naval Medical Research & Dev. Command National Naval Medical Center Bethesda, MD 20014
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NAME	ORGANIZATION
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J.W. Johnson, CAPT, MC, USN	NRMC Branch Clinic Unit Ident. Code 32529 Naval Amphibious Base, Little Creek Norfolk, VA 23521

<u>NAME</u>	<u>ORGANIZATION</u>
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B.J. Blankenship, CAPT, MC, USN	Submarine Force, U.S. Atlantic Fleet Norfolk, VA 23510
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J.E. Pinkerton, HMC, USN	Code N13 Force Medical Office Naval Surface Forces Pacific San Diego, CA 92155
J. Silva, Ph.D.	Code 823 Naval Ocean Systems Center San Diego, CA 92152
W.T. Rasmussen, Ph.D.	Code 5123 Naval Ocean Systems Center San Diego, CA 92152
I. Stevens	Code 5123 Naval Ocean Systems Center San Diego, CA 92152

## APPENDIX A

### RMDS TRIP REPORT 29 SEPT - 7 OCT 1980

As recommended at the RMDS design review meeting 27-28 Aug 1980, several follow-up meetings were held during 29 Sept - 7 Oct 1980 between Mr. I. Stevens (NOSC), Mr. C. Zekan (WESTEC Services, Inc.) and representatives at various Naval activities. This appendix is a report of those meetings.

<u>Places Visited</u>	<u>Dates</u>
COMNAVSECGRU	9/30/80
NAVELEXSYSSECENGCE	9/30/80
NAVSEA	9/30/80
COMNAVTELCOM	10/1/80
NAVELEX	10/2/80
CNM	10/2/80
NMRDC	10/3/80
CNO	10/3/80
NAVELEXSYSENGCEN, Vallejo	10/7/80

# RMDS TRIP REPORT (9/29/80 - 10/7/80) ACTION ITEMS

<u>Naval Activity</u>	<u>Action Item</u>	<u>See Trip Report Item #</u>	<u>Date Required</u>
OP-098E	1. Request COMOPTEVFOR Support	7(a)	ASAP
	2. Encryption Requirement Policy; letter to NOSC	1(a) & 7(c)	1 Mar 81
	3. Encryption technical requirements to OP-941J	1(b)	1 Apr 81
BUMED	1. Letter to NAVELEX requesting their participation	7(f)	ASAP
	2. Brief CINCFLETS on RMDS	3(a) & 7(n)	1 Apr 81
	3. Users' Conferences	7(n)	1 Jun 81
	4. Request PASU/ASU from NAVMAT	7(m)	Oct 84
NMRDC	1. Users' protocol established	7(o)	1 Mar 81
	2. Journal article on RMDS	7(g)	1 Apr 81
	3. Submit TEP for CNO approval	5	1 Apr 81
	4. Request to OP-941E and OP-986C for uhf satellite use	3(b) & 7(h)	1 Sept 81
NOSC	1. Submit TEP draft to MAT-083E	5	15 Jan 81
	2. Comm. & encryption technical requirements to OP-098E/OP-9896C	1(b) & 7(e)	15 Mar 81
	3. Fleet Service Request to OP-983	5 & 7(k)	1 Jun 81
	4. Telecommunication Service Request (TSR) to NAVTELCOM	3(d)	1 Jul 81
	5. Brief (MAT-042 and MAT-08D)	7(d)	ASAP



1. COMNAVSECGRU & NAVELEXSYSSECENG CEN (9/30/80)

Contacts: COMNAVSECGRU: C.W. Eighmey, CWO, USN, Code G60,  
AV 292-0542  
NAVELEXSYSSECENG CEN: Bob Roman, AV 292-0619, -0679;  
Don Howard, Howard Brown, Ramiro Montalvo, AV 292-2280

The possible use of a STU-2 scrambler telephone for RMDS data transmission between a NAVCOMMSTA or SATCOMSTA and an NRMC was discussed. The STU-2 was developed predominantly for commercial use as a low grade voice quality device. As such it is not technically acceptable for RMDS use.

Personnel at COMNAVSECGRU are primarily concerned with signal security, but not with technical aspects. Thus, a meeting was held with Bob Roman, Don Howard, Ramiro Montalvo, and Howard Brown, all with Naval Electronics Systems Security Engineering Center (NAVELEXSYSSECENG CEN) involved in cryptograph security and requirement work. The following points were discussed:

- a. The RMDS CNO Development Coordinator, CAPT R. Ireland, Code OP-098E, should establish whether there is a requirement to encrypt RMDS voice/data communications between ship and NRMC ashore.
- b. Cryptograph requirements must be validated by CNO, OP-941J, John Boyd. An internal OPNAV memo will be needed from OP-098E to OP-941J describing the technical parameters, identifying the requirement, and specifying when, what, and how many devices would be needed.

2. NAVSEA (9/30/80)

Contact: Simone Kfoury, Code PMS-04084, AV 222-8350

First article testing of the RMDS-EDMs was discussed in detail. It was recommended that the best way to proceed would be to require the contractor to perform the testing. In this case the contractor would prepare a test plan and test procedures and present them to NOSC Codes 5123 and 9331 for approval. As soon as the test plans and procedures are established and approved, the contractor could commence first article testing on one or more systems simultaneously under DCAS' supervision. After testing is finished, repair should be done by contractor to restore the system to its original working condition. Reliability testing is always done last. Parts and materials must be military standard in accordance with MIL-STD-242. Equipment labeling must satisfy MIL-STD-275. Temperature requirements can be relaxed. Reliability engineers usually advise on required temperature ranges. For humidity test, the time exposure will be shortened. Salt fog, sunshine, fungus, wind velocity, icing hydrostatic pressure, underwater explosion, gunblast and nuclear air blast tests are not required when military standard parts are used. Airborne noise is to meet requirements of MIL-STD-740B, Grade C. Structureborne noise is to meet requirements of MIL-STD-740B, Type 3. In both cases, solidly mounted equipment is to be considered. Tests whose requirements will be relaxed must be described in RMDS specification without the exceptions; then, the exceptions are to be described in the Statement of Work (SOW). The SOW takes

precedence over the specification. Tests such as weld, water cooling can be deleted. Thermal design can also be deleted since it is part of the reliability testing and it would be covered in the reliability prediction report down to the components level. There is no magnetic testing. The contractor should provide NOSC with a list of magnetic materials used to be approved or disapproved. Accelerated life test can be deleted. All cabinets used must be MIL-STD approved boxes. Langley Corp. and Raytheon build such boxes. S. Kfoury offered to review the RMDS EDM specification. Reliability people at NAVSEA will also comment on it.

The contractor makes a request for nomenclature via DD Form 61; the RFP CDRL should require this. The contractor should also be required to submit monthly progress reports. The following instructions are to be used for ASU: NAVSEA INSTR 4720, NAVMAT INSTR 4720.1 and OPNAV INSTR 4720.9D. Dr. W. Willoughby, NAVMAT-08D, Crystal Plaza 5, AV 222-9058, tests every system for ASU. He is a reliability and thermal design specialist. He should be contacted in order to find out how much emphasis is placed on different requirements in connection with ASU. Also, Al Ganz, NAVMAT-042, should be briefed on the RMDS.

All provisioning data, documentation required by Ship Parts Control Center (SPCC), must be supplied for RMDS production models only.

3. NAVTELCOM (10/1/80)

Contacts: Glenn Williams, Code 223, AV 202-0813  
John Furey, Code 21 (Requirements), AV 292-0300  
Mary Page, Code 21F  
Joe Klopfenstein, Code 1112, AV 292-0573  
Woody Wells, CDR, USN, AV 292-0400

For RMDS EDM tests' use of a uhf satellite channel, a Telecommunication Service Request (TSR) is to be filed by NOSC through NAVTELCOM and NAVELEX. A separate TSR needs to be filed in the same manner for hf test use.

To obtain approval to utilize uhf satellite channel for production RMDS, the following is required:

- a. FLTCINCs must be briefed and their approval obtained for uhf satellite use.
- b. A formal letter should be sent from NMRDC via BUMED to CNO (via OP-098E) to establish the need for the request, and to request permission for uhf satellite use. Approval will be required from OP-941E (see also item 7-h).
- c. Joint Chiefs of Staff (JCS) action may be required.
- d. A TSR initiated by NOSC is required.

Dedicated telephone lines conditioned and equalized for 4800 bps data transmission are to be used from the Defense Satellite Communication System (DSCS) station or NAVCOMMSTA to the NRMCM where the RMDS shore terminal is to be located. The acquisition of the telephone lines required is achieved through submission of the TSR to NAVTELCOM. On the West Coast, telephone lines between DSCS station at Stockton, CA and NRMCM Oakland, CA are to be considered. Estimated cost is \$124 per month plus \$42 per month per line for C2 conditioning and a one-time installation charge of \$110. On the East Coast, telephone lines between DSCS stations Norfolk, VA and NRMCM Portsmouth, VA are to be considered. Estimated cost is about \$75 per month plus \$42 per month per line for C2 conditioning and a one-time installation charge of \$110.

Costs are to be covered by BUMED or possibly by NAVTELCOM; a decision at CNO level will be required.

Besides the two NRMCMs mentioned above, NRMCM Bethesda, MD could also be considered. This medical center is unique in that it has a communications center with secure space.

A request for approval through CNO must be submitted to DCA Code 480, designers, and Code 515, operations, for any RMDS auxiliary equipment proposed to be located at a DSCS station. The request should include:

- (1) Physical description and layout of the 19-in. rack-equipment.
- (2) Physical requirements and other technical parameters of the equipment.

4. NAVELEX (10/2/80)

Contacts: Bruce Harrison, Code 5107, AV 222-8461  
Jack Ricketts, Code 3302, AV 222-6084  
Irwin Smietan, Code 501, AV 222-8482

According to Bruce Harrison, as long as RMDS is classified as a TV system no militarization/ruggedization, OPEVAL, and ASU are required. It appears that the above held true for the several (2-3) systems that he put aboard ship; however, it does not seem to pertain to RMDS, which could be installed on almost half the ships in the Navy. In addition, everyone else contacted during this trip suggested the requirements for militarization/ruggedization, OPEVAL, and ASU.

Irwin Smietan, Code 501, was briefed on the RMDS project. He agrees that the RMDS needs a NAVELEX representative officially designated as such who can give NOSC guidance during EDM development; however, they are short on manpower. He is of the opinion that ASU will definitely be required in order to obtain OPN production funds.

A copy of the RMDS NDCP was submitted to him. He will discuss these problems with others at NAVELEX and respond.

5. CHNAVMAT (10/2/80)

Contacts: J. Sivy, MAT-083E, AV 222-2646  
Barbara Riley, AV 222-2646

According to J. Sivy and Code OP-987, as of September 1980, RMDS is ACAT III category and a TEMP is required (see item 7-a).

OPTEVFOR must be kept informed about RMDS testing and installation requirements, especially on the smaller ships. Fleet services request must be filed through OP-983, LCDR R. Porter, in accordance with enclosure (4) of OPNAVINST 3960.10A as soon as possible. As soon as a draft TEMP is ready, seven copies should be sent to J. Sivy's office for unofficial review and comments. The final TEMP must be sent from NMRDC to CNO (OP-098E) via BUMED and NAVMAT (J. Sivy) for official review and approval.

An ILSP and Naval Training Plan (NTP) should also be prepared as soon as possible.

TRIMIS may be interested in RMDS. It should be kept in mind as a future possibility. ADM Linder at Office of the Secretary of Defense (OSD) is a point of contact.

6. NMRDC (10/3/80)

Contact: J. Bates, CDR, USN, AV 295-1499

Discussion concerning RMDS financial problems was held with CDR J. Bates. More updated details should be included in the RMDS Form 1498. The "Approach" section must be updated; costs explained and updated; the "Objective" section needs to be expanded.

With the amount of funding available for RMDS in FY 81, it was decided to purchase one or two RMDS terminals in FY 81, with testing performed for ruggedization. There would be an option to purchase the additionally required RMDS terminals at a later date during the following Fiscal Year, when additional funding would be available.

7. CNO (10/3/80)

Contacts: R. Ireland, CAPT, MC, USN, Code OP-098E, AV 225-3442  
S. Bauerlein, LCDR USN, Code OP-983D2, T&E Coordinator,  
AV 225-3174  
J.O. Blake, LCDR, USN, Code OP-986C, SATCOM Development  
Coordinator, AV 225-2168

The following items were established during this meeting with CAPT R. Ireland, CDR J. Bates, LDCR S. Bauerlein, LCDR J.O. Blake, Dr. A. Forrey, and I. Stevens. The items with asterisks are action items.

- \*a. The RMDS project will be ACAT IV. Thus, the SYSCOM, BUMED, will have a decision role in establishing the requirements to obtain ASU. A decision was made that the present TEMP will be renamed TEP but the depth and complexity of it will remain as is. OPTEVFOR's support will be officially requested by CNO. OPTEVFOR will also be requested to perform an OPEVAL, which could be done as the last part of the TECHEVAL, or it could be a separate evaluation after the TECHEVAL has been completed.
- b. J. Sivy at CNM must be kept closely informed regarding RMDS progress in the TEMP, TECHEVAL, OPEVAL, and ASU.
- \*c. CNO, OP-098E, will send an official letter to NOSC establishing the requirement to encrypt all RMDS data from ship to an NRMC ashore.
- \*d. Al Ganz, MAT-042, and Dr. W. Willoughby, MAT-08D, are involved in ASU. They must be briefed by NOSC.
- \*e. After the CNO requirement for encryption is established (c, above), NOSC should send an official letter to LCDR J.O. Blake, OP-986C, via NMRDC and BUMED, describing the RMDS project and communication requirements.
- \*f. BUMED (as OP-093) should send an official letter to NAVELEX requesting their help and involvement in the RMDS project.
- \*g. CDR J. Bates and Dr. A. Forrey will write an article on RMDS for the Institute Proceedings; RADM McDermott, CINCLANTFLT Medical Officer, will be contacted regarding this.
- \*h. NMRDC, via BUMED, should send an official letter to CNO (OP-986C) establishing the need for and requesting permission for uhf satellite use for the RMDS production models.
- i. RMDS emergency transmission times are to be: threshold -- 30 minutes, and goal -- 15 minutes. These figures must be reflected in the TEP and TSR.
- \*j. In a medical emergency, a corpsman aboard ship would request a communications channel for RMDS use. The minimum time required by radio to set up the communications channel must be established and specified in the TEP and TSR.
- \*k. Fleet support services for TECHEVAL and OPEVAL must be requested 18 months in advance. Uhf line of sight radio transmission must be specified since it affects ships operation. The request is to be filed through OP-983, LCDR Porter, in accordance with enclosure (4) of OPNAVINST 3960.10A.

1. RMDS will be designed to interface with the Demand Assigned Multiple Access (DAMA) system when a uhf satellite channel is utilized. DAMA, however, may slip timewise in obtaining an ASU. In this case, RMDS would have to obtain a Provisional ASU (PASU).
  - \*m. BUMED should request a PASU or ASU through NAVMAT. The following instructions apply: OPNAV INST 4720.9D; NAVMAT INST 4720.1; NAVSEA INST 4720.
  - \*n. The CINCs on the East and West coasts must be briefed about the RMDS; benefits, procedures, requirements, utilization, etc. Their assistance should be requested to arrange a users' conference on each coast.
  - \*o. Dr. A. Forrey is to check on establishing an RMDS transmission protocol for the corpsman's use in order to be able to meet the 15-minute goal for maximum transmission time.
8. NAVELEXSYSENGCEN, Vallejo, CA (10/7/80)

Contacts: D. Aldous, R. Goodman, R. Benson, \*Code POW-2, AV 253-4127  
(\*Code POW-2 has been redesignated Code 240)

The following items were discussed during a meeting with D. Aldous, R. Goodman, and R. Benson:

- a. The RMDS terminals and their installation aboard ship or ashore will have to meet all TEMPEST requirements in accordance with NACSEM 5100. The RMDS specification must require this.
- b. When the EDMs are available, NAVELEXSYSENGCEN must test them for approval as low level emanation systems. If not approved as such, the RMDS shipboard installation will be much more expensive, about \$50 to \$100 per foot, since high level emanation systems require cables to be routed in metal pipe in order to meet TEMPEST requirements.
- c. RMDS can be separated into two parts: a control unit, 19"x18"x24," and the rest of the system to fit in a 3 foot, 19 inch rack. The control unit would be located in a convenient place in sickbay at eye level. The second part would be located either within sickbay or in an adjacent storage area with a cable connection between the two. Cost of installation for a two-part RMDS could be double or more, because the installation of the extra cabling between the two parts must meet TEMPEST requirements.
- d. The racks required to support the two RMDS parts described in c, above, would be provided as part of the installation of the RMDS aboard ship.

- e. Most small ships, e.g., DD, FFG, FF, etc., have only two ON-143s and two KG-36s, for NAVMAX (fleet operations communications) and Secure Voice (SV). A few ships have only NAVMAX, which is always in use. It is highly unlikely that RMDS would be allowed to use the uhf satellite channel and NAVMAX communications equipment at the expense of fleet operations. A consideration must be given to justifying the purchase (or acquisition) of ON-143s and KG-36s for RMDS use on many of the classes of ships as described above.

## APPENDIX B

### SHIP SPACE AVAILABILITY SITING REPORT

In accordance with recommendations from the Design Review Meeting of 27-28 Aug 1980, I. Stevens and P.D. Hayes of NOSC (Code 5123), and R. Benson and D. Griffanti of NAVELEXSYSENGCEN, Vallejo, CA visited eight ships of five classes to assess feasible space availability in sickbay or other possible locations for an RMDS terminal. These visits were not with the intention of installation of an RMDS now or in the near future on any of these ships, but rather to determine the constraints on space availability and installation on smaller class ships, which will have an impact on the design of the RMDS Engineering Development Models (EDMs).

The following ships were visited while in port, San Diego, CA:

<u>Ship</u>	<u>Date of Visit</u>
USS OKINAWA (LPH-3)	14 Oct 80
USS DAVID R. RAY (DD-971)	14 Oct 80
USS TRIPOLI (LPH-10)	15 Oct 80
USS ELLIOT (DD-967)	15 Oct 80
USS GRAY (FF-1054)	15 Oct 80
USS HULL (DD-945)	16 Oct 80
USS BELLEAU WOOD (LHA-3)	16 Oct 80
USS WADSWORTH* (FFG-9)	20 Oct 80

The following siting report was prepared by NAVELEXSYSENGCEN, Vallejo, CA, following the ship visits. It was the general conclusion of these siting visits that on the small-class ships (such as the DD, FF or FFG) the RMDS terminal can be installed, but may have to be arranged in two separate racks and possibly installed in separate areas, varying depending upon the individual ship.

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\*This ship was not visited by personnel from NAVELEXSYSENGCEN, Vallejo, and hence, is not included in the following report. However, information for this ship is similar to that for the FF and DDs.



REMOTE MEDICAL DIAGNOSIS SYSTEM (RMDS)

SHIP SPACE AVAILABILITY

SITING REPORT

Prepared By:

Naval Electronic Systems Engineering Center  
Vallejo, California

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## 1.0 INTRODUCTION

This report outlines the results of a ship siting trip conducted by NAVELEX-SYSENGCEN, Vallejo at NAVSTA San Diego during the period 14-16 October 1980. The purpose of the trip was to provide NAVOCEANSYSCEN, San Diego (Code 5123) planning information and recommendations for shipboard installations of the Remote Medical Diagnosis System (RMDS).

## 2.0 OBJECTIVES

The primary objectives of the siting trip were:

- a. Identify where, in the medical center, space is available for installation.
- b. Determine installation requirements.
- c. Determine availability of medical equipment to be used with RMDS.
- d. Determine availability of existing radio equipment required to interface with RMDS.
- e. Determine RMDS hookup and system operation.

The following ships were surveyed:

- a. USS OKINAWA (LPH-3)
- b. USS TRIPOLI (LPH-10)
- c. USS DAVID R. RAY (DD-971)
- d. USS ELLIOTT (DD-967)
- e. USS BELLEAU WOOD (LHA-3)
- f. USS HULL (DD-945)
- g. USS GRAY (FF-1054)

## 3.0 FINDINGS

### 3.1 USS OKINAWA (LPH-3)

The USS OKINAWA medical center was surveyed and found to contain two areas which could hold RMDS. One was the doctor's office and the other the examining room. The ship was in favor of installing the unit in the doctor's office. Installation of RMDS in the doctor's office would be unsatisfactory as this system will be used to treat patients who are normally treated in the examining room.

The USS OKINAWA is considered a large ship, and therefore the RMDS Terminal can be installed in a single rack; most likely it would be placed in the examining room. No specific equipment location will be provided at this time since the unit can be installed anywhere within the examination room. The camera can be permanently mounted over the examining room table (see section 4.0c for further discussion).

During the ship siting it was determined that the ship had ECG and X-ray equipment on board. No foreseen problems will arise from the X-ray equipment but problems could arise in using the ECG equipment with RMDS. The problem is the ECG equipment is located in a different part of the medical center, which makes its use impossible with RMDS. It is suggested that when installing RMDS, remote cables be provided from the RMDS terminal to the ECG equipment.

On the ship there will be no problems in availability of existing cryptos, ON-143(V)4/USQ Interconnection Group or hf/uhf transmitters and receivers. For interfacing RMDS with uhf SATCOM (and hf/uhf radio if encryption is required) the installation will use an existing Secure Voice ON-143(V)4/USQ with its associated KG-36 Crypto. The System Block Diagram along with the operation of these interfaces will be discussed in detail in Exhibit 1.

### 3.2 USS TRIPOLI (LPH-10)

The USS TRIPOLI is the same class of ship as the USS OKINAWA. Medical spaces are arranged the same. All installation requirements and equipment for this ship will be as discussed in paragraph 3.1

### 3.3 USS DAVID R. RAY (DD-971)

The USS DAVID R. RAY medical center was surveyed and found to contain only one area in which RMDS could be installed, the examining room.

This is a small ship and will require installation of the RMDS in two separate racks. Two locations exist in the examining room in which the electronics portion of the RMDS can be installed. One is under the examining table and the other is against the forward bulkhead. The first location, under the examining table, is not recommended for the following reasons: one, when RMDS is turned "ON" the equipment will tend to heat up the examining table; and two, when the medic is working around the table he could possibly kick the equipment, damaging it. The second location is on the forward bulkhead and will only require the removal of a temporary locker. This location is better suited for the installation because it is out of the way and less susceptible to damage. The camera used with the RMDS can be permanently mounted over the examining table (see section 4.0c for further discussion).

During the ship siting it was determined that the ship had no ECG or X-ray equipment on board. It is suggested that the ECG equipment be procured with the RMDS to provide maximum use.

On this ship there will be no problems in availability of existing cryptos, ON-143(V)4/USQ Interconnection Group or hf/uhf transmitters and receivers. For interfacing RMDS with uhf SATCOM (and hf/uhf radio if encryption is required) the

installation will use an existing Secure Voice ON-143(V)4/USQ Interconnection Group with its associated KG-36 Crypto. The System Block Diagram along with the operation of these interfaces will be discussed in detail in Exhibit 1.

#### 3.4 USS ELLIOTT (DD-967)

The USS ELLIOTT is the same class of ship as the USS DAVID R. RAY. Medical spaces are arranged the same. All installation requirements and equipment for this ship will be as discussed in paragraph 3.3.

#### 3.5 USS BELLEAU WOOD (LHA-3)

The USS BELLEAU WOOD medical center was surveyed and found to contain two examining rooms, either of which could hold RMDS.

This is a large ship and the RMDS Terminal can be installed in a single rack in either of the examining rooms. No specific spot will be provided at this time since the unit can be placed just about anywhere in either room without relocation of any major equipment. The camera, used with the RMDS, can be permanently mounted over the examining room table (see section 4.0c for further discussion).

During the ship siting it was determined that the ship had ECG and X-ray equipment on board. No foreseen problems exist.

On the ship there will be no problems in availability of existing cryptos, ON-143(V)4/USQ Interconnection Group or hf/uhf transmitters and receivers. For interfacing RMDS with uhf SATCOM (and hf/uhf radio if encryption is required) the installation will use an existing Secure Voice ON-143(V)4/USQ with its associated KG-36 Crypto. The System Block Diagram along with the operation of these interfaces will be discussed in detail in Exhibit 1.

#### 3.6 USS HULL (DD-945)

The USS HULL medical center was surveyed and found to contain no area in which to install the full RMDS. It was determined during the ship siting that the electronics portion of the RMDS would have to be located in another remote space (ie, TTY repair located across the passageway from medical) and connected to the control/display unit and camera (in the medical center) by cables. During the ship siting it was determined that installation of the electronics in TTY repair room would lead to no major problems; there is enough room for installation without any major relocation of equipment. The RMDS control/display unit can be bulkhead mounted in medical with no major problems. The camera can be permanently mounted over the examining room table (see section 4.0c for further discussion).

During the ship siting it was determined that the ship had no ECG or X-ray equipment on board. It is suggested that the ECG equipment be procured with RMDS to provide maximum use.

On this ship there will be a problem in trying to interface RMDS with existing uhf SATCOM equipment; no problem will exist with hf/uhf transmitters and receivers.

For interfacing RMDS with uhf SATCOM only one (1) ON-143(V)4/USQ Interconnecting Group is installed. This ON-143(V)4/USQ is not available for interfacing RMDS (ie, NAVMACS is installed in the port required for RMDS). There are two possible solutions to the problem; the first is to install an extra ON-143(V)4/USQ and its associated crypto. Due to the cost of procuring the extra equipment this solution is unsatisfactory and will be explained further in section 4.0h. The correct solution will be to add a transmitter transfer switchboard (SB-988/SRT) to switch RMDS on line and NAVMACS off line when required. For interfacing RMDS with hf/uhf radio the interface will be the same as previously described. The System Block Diagram along with the operation of these interfaces will be discussed in detail in Exhibit 2.

### 3.7 USS GRAY (FF-1054)

The USS GRAY medical center was surveyed and found to contain no area in which to install the full RMDS. As on the HULL, it was determined that the electronics portion would have to be located in another space (ie, drug storage space located across the passageway from medical) and connected by cables to the control/display unit and camera in the medical center. During the ship siting it was determined that installation of the electronics in the drug space would lead to no major problems; there is enough room for installation without any major relocation of equipment. The RMDS control/display unit can be bulkhead mounted in medical with no major problems. The camera can be permanently mounted over the examining room table (see section 4.0c for further discussion).

During the ship siting it was determined that the ship had no ECG or X-ray equipment on board. It is suggested that ECG equipment be procured with RMDS to provide maximum use.

On this ship there will be a problem in trying to interface RMDS with existing uhf SATCOM equipment; no problem will exist with hf/uhf transmitters and receivers. For interfacing RMDS with uhf SATCOM only one (1) ON-143(V)4/USQ Interconnecting Group is available (ie, NAVMACS is installed in the port required for RMDS). There are two possible solutions to the problem; the first is to install an extra ON-143(V)4/USQ and its associated crypto. Due to the cost of procuring the extra equipment this solution is unsatisfactory and will be explained further in section 4.0h. The correct solution will be to add a transmitter transfer switchboard (SB-988/SRT) to switch RMDS on line and NAVMACS off line when required. For interfacing RMDS with hf/uhf radio the interface will be the same as previously described. The System Block Diagram along with the operation of these interfaces will be discussed in detail in Exhibit 2.

## 4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the ships surveyed, the following recommendations are provided:

### a. Equipment Design

It was noted during the ship siting that the smaller ship may have problems in locating room to install all RMDS equipment within one

area. It is suggested that the terminals be designed so that the electronics/data unit can be separated from the control display unit. The equipment should be designed to mount from the front and bottom.

b. Equipment TEMPEST

There will be no foreseen TEMPEST problems if the equipment meets the NACSEM 5100 requirements.

c. Camera Installation

It was proposed during ship siting to install the camera above the examining table. The foundation requirement can be determined at the time of installation. The foundation can be made to move to any location and height over the table. The installation can also be made so that, if required, the camera can be disconnected from the mount and moved to another location for use.

d. Electrocardiogram (ECG) Equipment

It was noted, during the ship siting, that smaller ships usually do not have any ECG equipment. It is suggested that to improve the ship's medical capability with RMDS the ship, at time of installation, be provided with ECG equipment.

e. Equipment Foundations

It is suggested that all required four foot equipment racks (MT-2299/SRC) and six foot equipment racks (CY-4516A/U) be provided, by the installing activity, at time of installation. The installing activity will determine, at the time of installation, if racks or special foundations will be required.

f. 22MC Voice Circuit to Radio

It was noted during each siting that there was no means for the medical center to talk with radio. During equipment installation a 22MC Voice Circuit will be provided.

g. Cryptos Used

It was determined during the sitings that for Satellite Communication (and hf/uhf radio communication, should encryption be required), the TSEC/KG-36 Crypto in conjunction with the ON-143(V)4/USQ Interconnecting Group will be used.

h. Installation of a Dedicated ON-143(V)4/USQ Interconnecting Group

During ship siting of the USS HULL and USS GRAY, smaller ships with only one SATCOM transceiver (AN/WSC-3) on board, it was determined that each has only one ON-143(V)4/USQ installed. This

ON-143(V)4/USQ is dedicated to NAVMACS and Secure Voice Systems; no room is available for RMDS to interface. It was determined that providing a dedicated ON-143(V)4/USQ would not be cost effective since only one ON-143(V)4/USQ could be operated at a time. It is suggested that a transmitter transfer switchboard (SB-988/SRT) be provided to switch NAVMACS off line from the ON-143(V)4/USQ and RMDS on line when its use is required.



## EXHIBIT 1

### 1. EQUIPMENT LOCATION AND OPERATION

#### a. RMDS Terminal

As shown in figure B-1, the RMDS Terminal will be installed in the medical center examining room. The operator will set the RMDS Terminal to the appropriate output for operation via satellite, hf or uhf line of sight.

#### b. SATCOM Operation

The existing Secure Voice ON-143(V)4/USQ with its appropriate TSEC/KG-36 Crypto will be used to interface with the existing SATCOM transceiver. To operate via satellite, the RMDS operator will notify Radio Central to patch the ON-143(V)4/USQ from the voice mode to data mode, and provided the SATCOM transceiver is patched in, the system will be ready to operate. As shown, the ON-143(V)4/USQ and TSEC/KG-36 Crypto are located in Radio Central Crypto Room.

#### c. HF/UHF Line of Sight Operation

To use hf or uhf line of sight with the RMDS, hook-up will be accomplished through the existing SATCOM patch panel SB-988/SRT or equivalent.

# EXHIBIT 1

System shown below is for use with ships with more than one AN/WSC-3 Satellite Transceiver.

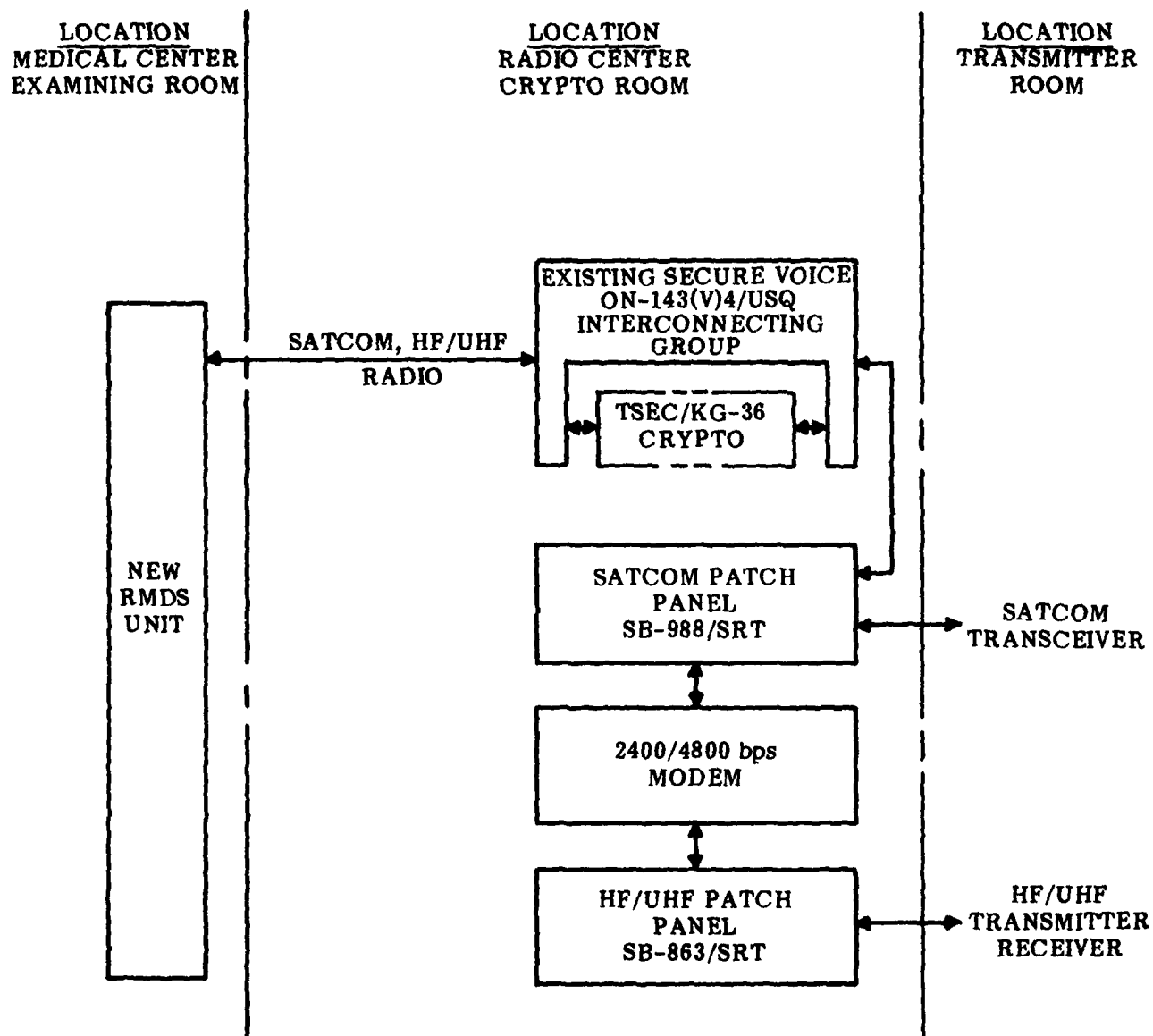


Figure B-1. RMDS communications configuration for ships with more than one AN/WSC-3 satellite transceiver.

## EXHIBIT 2

### 1. EQUIPMENT LOCATION AND OPERATION

#### a. RMDS Terminal

As shown in figure B-2, the RMDS Terminal will be installed in medical center examining room (NOTE: This will not always be possible on small ships as demonstrated during siting USS HULL and USS GRAY). In operation via satellite, hf or uhf line of sight, the operator will set the RMDS Terminal to the appropriate output.

#### b. SATCOM Operation

The existing NAVMACS ON-143(V)4/USQ with its appropriate TSEC/KG-36 Crypto will be used to interface with the existing SATCOM transceivers. To operate via satellite, a new SB-988/SRT Transmitter Transfer Switchboard will be installed between the ON-143(V)4/USQ, and RMDS Terminal or NAVMACS. The RMDS operator will notify Radio Central to patch the RMDS to the ON-143(V)4/USQ via SB-988/SRT, and provided the SATCOM transceiver is patched in, the system will be ready to operate. As shown, the SB-988/SRT, ON-143(V)4/USQ and TSEC/KG-36 Crypto are located in Radio Central Crypto Room.

#### c. HF/UHF Line of Sight Operation

To use hf or uhf line of sight with the RMDS, hook-up will be accomplished through the existing SATCOM patch panel SB-988/SRT or equivalent.

## EXHIBIT 2

System shown below is for use with ships with only one AN/WSC-3 Satellite Transceiver.

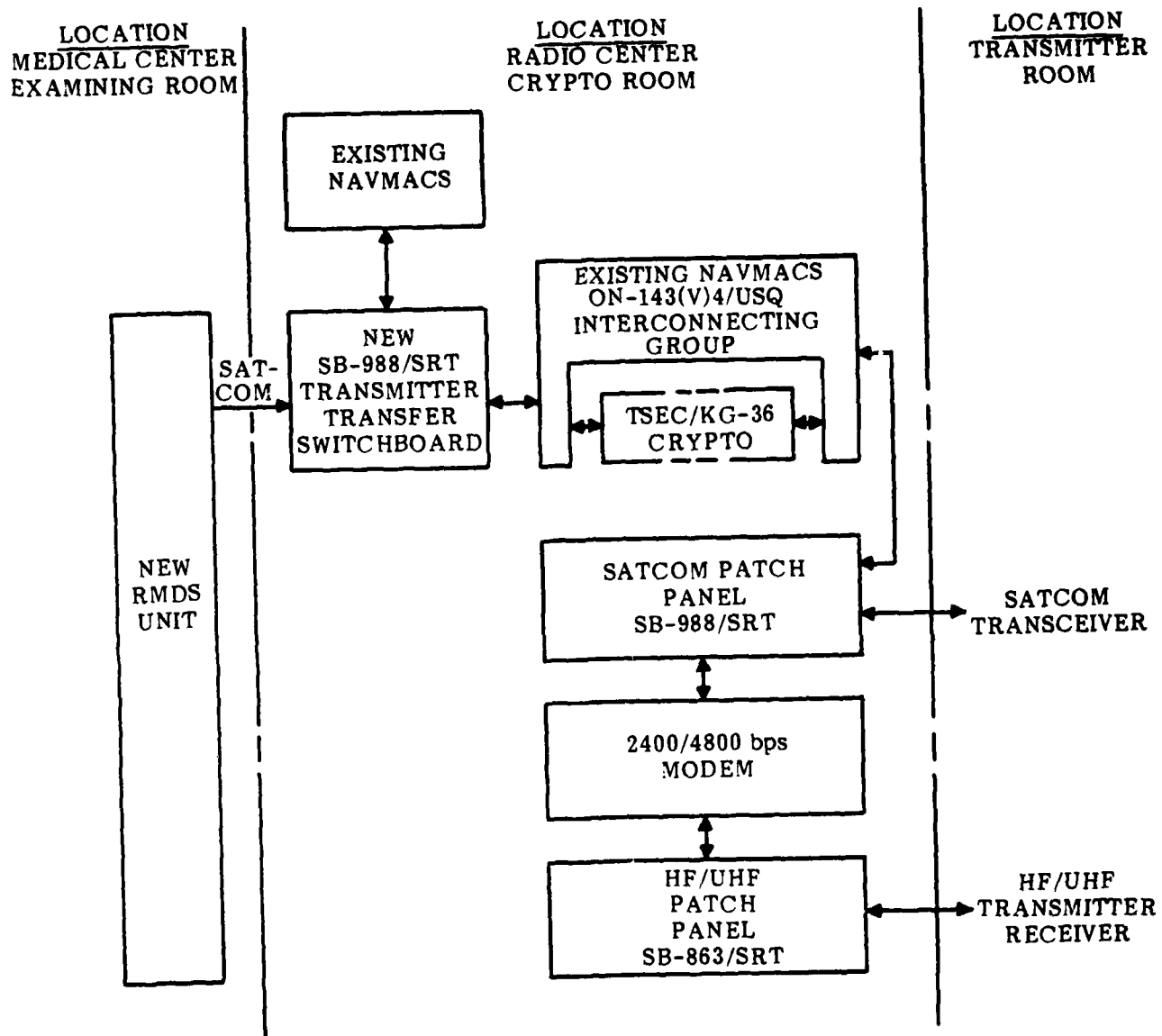


Figure B-2. RMDS communications configuration for ships with only one AN/WSC-3 satellite transceiver.

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